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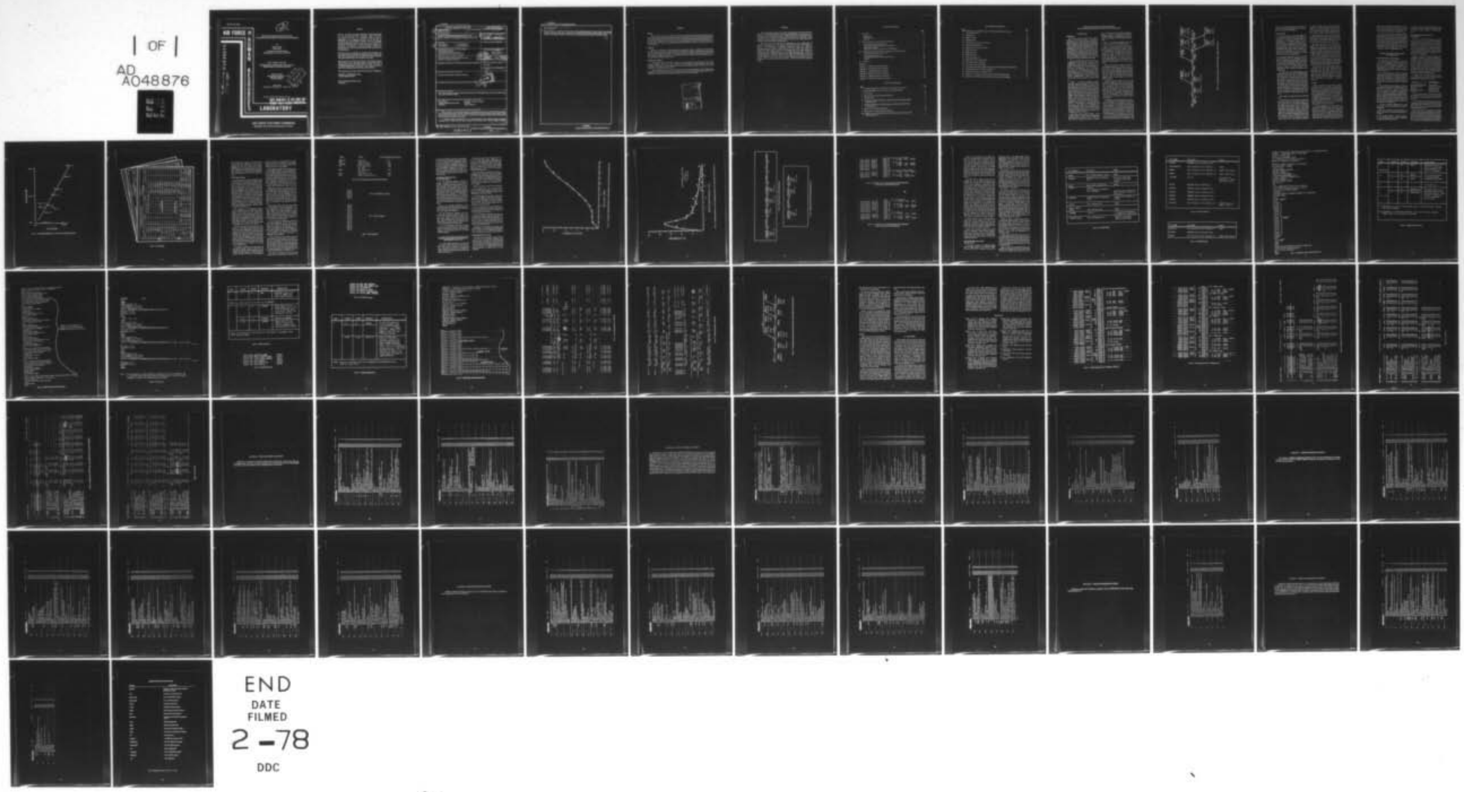

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AIR FORCE HUMAN RESOURCES

PREDICTING POWERED SUPPORT EQUIPMENT AND ASSOCIATED MAINTENANCE MANPOWER REQUIREMENTS

By

Robert N. Deem
Verlesta Hicks

ADVANCED SYSTEMS DIVISION
Wright-Patterson Air Force Base, Ohio 45433

Guy N. Faucheux, Capt, USAF

Maintenance and Supply Management Engineering Team
Wright-Patterson Air Force Base, Ohio 45433

Sharon R. Nichols
Systems Research Laboratories, Inc.
2800 Indian Ripple Road
Dayton, Ohio 45440

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GORDON A. ECKSTRAND, Director
Advanced Systems Division

DAN D. FULGHAM, Colonel, USAF
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There is a need for a more responsive method for predicting the ground support equipment (SE) requirements and the related SE maintenance manpower requirements associated with newly developing weapon systems. A study was conducted whose purpose was to develop such a method by first establishing the basic analytical rationale, and then by creating a users' guide for the method.

A computer program was developed from an existing maintenance data collection program. It processes maintenance data on operational SE in order to produce the information needed to conduct a Logistics Composite

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Model simulation of proposed SE work centers for newly developing aircraft. Primary inputs are the standard 6-month maintenance tapes kept at base level, and completed AF Forms 864 which provide records of SE utilization. The program is currently in operation on the Aeronautical Systems Division's CDC 6600 computer.

SUMMARY

Problem

There is a need for a more responsive method for predicting the ground support equipment (SE) requirements and the related maintenance manpower requirements for aircraft systems during development. This method should provide early estimates for use in trade-offs and evaluations, and should be sensitive to the operational requirements of the aircraft. This report addresses a study effort whose purpose was to develop such a method by first establishing the basic analytical rationale, and then by creating a users' guide for the method.

Approach

With the cooperation of many people and organizations involved in Logistics Composite Model (LCOM) studies, the necessary relationships between manpower, support requirements, and operational scenario were identified and verified. A computer program was developed from an existing maintenance data collection program to produce the information needed to conduct a LCOM simulation study of proposed support equipment work centers.

Results and Conclusions

The programs and methodologies developed were successfully used to simulate an A-7 powered support equipment work center, and to perform trade-offs between related manpower and support equipment requirements. It was demonstrated that this methodology provides the analyst with a next generation tool for addressing these factors.

This methodology has also been used to support the F-16 support equipment and the AMST support equipment LCOM simulation studies conducted by the Directorate of Equipment Engineering, Deputy for Engineering, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio.

PREFACE

The methodology described in this report was developed by the Advanced Systems Division, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base, Ohio. The effort was documented under task 11240405, Adaptation of Operations Research Techniques to Air Force Human Resources Problems, with Mr. Frank Maher as task scientist. Dr. Ross L. Morgan is project scientist for proiect 1124, Human Resources in Aerospace System Development and Operations.

The study effort was supported by individuals from many organizations. In addition to the listed authors, they include Lt Col Donald Tetmeyer and Mr. William D. Moody of the Directorate of Equipment Engineering, Deputy for Engineering, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio; TSgt N. A. Meireis, and TSgt Samuel Stevens of the Maintenance and Supply Management Engineering Team, Wright-Patterson Air Force Base, Ohio; Mr. Tom Cuff of the Aeronautical Systems Division Computer Center; MSgt Ward, MSgt Witchby, SSgt Ward and SSgt Robbins of the Myrtle Beach Air Force Base, South Carolina, A-7 powered support equipment work center; and Ms. Linda K. Hammen of the Advanced Systems Division, Air Force Human Resources Laboratory, who did the final draft typing and editing.

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I. INTRODUCTION

Background

This report outlines efforts which address weapon system maintenance manpower requirements as a function of support equipment (SE) requirements and operational requirements. Support equipment (SE) was previously referred to as aerospace ground equipment (AGE). The Logistics Composite Model (LCOM) has been used successfully in the recent past to accurately predict maintenance manpower requirements for the weapon systems themselves. This study addresses the feasibility of using LCOM to predict the maintenance manpower requirements for the SE; and then to determine the influence of the numbers and types of SE upon manpower requirements.

The term LCOM has gained wide acceptance throughout the Air Force as a reference to all LCOM related models. However, the LCOM model itself is just one of three or four models that can be used in a LCOM study. For this technical report, the term LCOM will refer to the LCOM model itself; the term MMM (Maintenance Manpower Models) will refer to all LCOM associated models. A full discussion of these models may be found in AFHRL-TR-74-97, Volumes I through VI. The full list and description of these models are:

1. *LCOM* – A computer simulation program based upon queuing processes and network analysis. When used for simulating a weapon system, branching networks are developed which represent the maintenance and flying activities associated with an operational scenario. The individual tasks within these networks have average completion times and completion time standard deviations. In addition, the servicing and maintenance tasks also demand specific manpower and SE resources. There are two types of maintenance activities represented by the networks: scheduled and unscheduled. The simulation of a given unscheduled activity is controlled by a clock associated with that activity. The clocks are set individually for the unscheduled activity to be simulated based upon the distribution parameters (mean, standard deviation) of the number of sorties between the unscheduled activity of interest.

2. *Maintenance Data Collection (MDC)* – These programs process weapon system maintenance data recorded in accordance with AF TO 00–20. The data are recorded on Air Force Technical Order (AFTO) Form 349 and then transferred to magnetic computer tapes designated ABD64-A. The MDC programs use ABD64-A tapes for input. Output provides data for the LCOM branching networks.

3. *Phase I* – This program processes input data for ready acceptance into the LCOM program.

Figure 1 is a typical LCOM branching network showing the various paths the courses of action may take, and also showing the supporting data. *The development of a complete set of such networks which would reflect all relevant operational activities is usually considered the climax of an LCOM study.* However, this is by no means a routine accomplishment. For example, there are approximately 300 such networks needed for an up-to-date LCOM simulation of the A-7 weapon system.

The network, depicted in Figure 1, deals with unscheduled maintenance on the gas turbine engine which is on the AM32-60 SE. This network presents task names (AAAE00), occurrence probabilities (e), personnel (AFSCs) required (423X5), mean task times (T), and SE (D-60) required for each task. Much of this type of data is usually obtained from the maintenance data collection (MDC) programs.

Although network development is the high point of an LCOM study, there would still remain much to be accomplished after this. Manning and SE requirements and/or associated sensitivity studies would come afterward. The LCOM model itself may be thought of as a mechanical tool which processes the network information in order to project final manning/SE recommendations. However, the utilization of the LCOM model is rote compared to the research required to develop the networks.

The MDC model was developed to process aircraft maintenance data. However, SE maintenance data are recorded on the ABD64-A tape also. It appeared feasible to obtain initial network insight and information for a proposed SE operational work center by processing this SE MDC data via the MDC model. The acquisition of this network information would bring closer to reality the LCOM simulation of a proposed SE work center for a newly developing weapon system. As is the case for weapon system network development, this initial SE network insight and information would

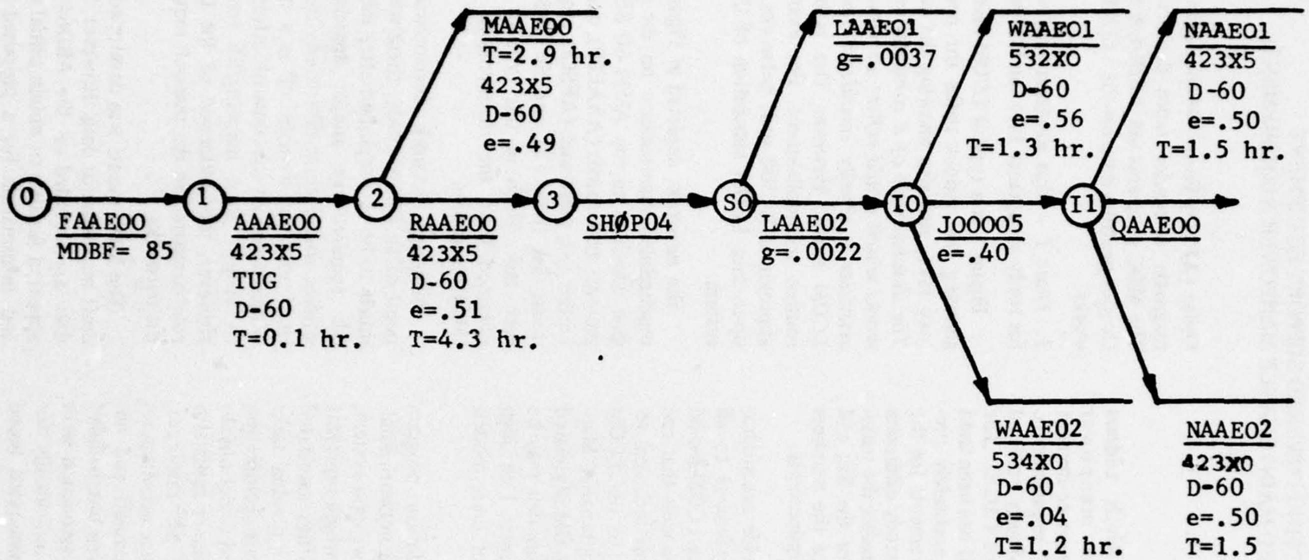


Figure 1. **Unscheduled maintenance, AM32-60 gas turbine engine, task networks.**

need to be discussed, adjusted, and verified via visits to the various SE operational work centers from whence came the MDC data.

Study Approach

It was first necessary to assure that MDC data for SE could be processed through the MDC programs with no more than a reasonable amount of modification to the programs needed. Second, a thorough study of typical powered SE work centers at Myrtle Beach AFB, South Carolina, and at Wright-Patterson AFB, Ohio, was completed before attempting to model an SE work center via the MMM models. Third, several modeling techniques were investigated in order to further identify and clarify the optimum manner in which an SE work center may be simulated.

New computer programs to process the MDC SE maintenance data were developed. This was done by modifying the existing MDC programs. The new programs process this data so that the SE network data for unscheduled maintenance activities are outputted in the same manner that the original programs outputted aircraft data. Appendices A thru F present the listings of these new programs.

Visits were made to the Wright-Patterson AFB powered SE work center and to the Myrtle Beach AFB powered SE work center to obtain insight into their system of operations and also to ascertain whether or not the centers would lend themselves to MMM modeling with only a reasonable amount of model revision. It was discovered that maintenance activities on SE are recorded in a very similar manner to that in which aircraft maintenance activities are recorded (i.e., in accordance with AF TO 00-20-2). The dispatching activity of SE was studied, and relationships were noted between SE dispatch activity and aircraft sortie rates.

The modeling was approached in two different ways:

1. *First Approach:* The networks and supporting data were developed for the SE work center in the same manner that they are usually developed for the parent weapon system; that is, by processing the ABD64-A tape data in order to gain initial insight and supporting information concerning the unscheduled maintenance networks. These networks were then verified by discussing them with skilled and experienced maintenance personnel at the work centers. Next the SE work centers' activities (dispatch rates by equipment type and number, and dispatch durations) were investigated in order to develop a work center scenario which "drives" the LCOM simulation model in the same manner that a weapon system's activities (sortie rate by aircraft type and number, and sortie durations) "drive" a weapon system LCOM simulation.

2. *Second Approach:* The SE networks and supporting data developed per the *first approach* were incorporated into the parent weapon system's (in this case the A-7) LCOM model so that the weapon system's scenario drove the simulation.

An initial LCOM model of the A-7D had previously been constructed at Advanced Systems Division, Air Force Human Resources Laboratory (AFHRL), Wright-Patterson AFB, Ohio. This model was updated, expanded and revalidated by AFHRL personnel and by maintenance specialists at Myrtle Beach AFB. The SE work center networks were first developed for an LCOM simulation of the Myrtle Beach SE work center per the *first approach*. Various simulations were accomplished in order to determine the relationships between SE maintenance manpower requirements, operational requirements, and SE requirements.

These SE work center networks were then incorporated into the A-7D LCOM model in accordance with the *second approach*. It was found that the *second approach* was more accurate than the *first approach*. However, the *first approach* is much less demanding in terms of run time, complexity and turn around time; and therefore, lends itself more readily to sensitivity analysis.

Overview

Section II outlines the revised MDC program development. Also, the feasibility of simulating an SE work center using LCOM is established. Significant data and data analysis results which support this feasibility contention are also presented. *A review and familiarity with Sections I through IV of AFHRL-TR-74-97(III) (which documents the original MDC program) are recommended in order to obtain a full understanding of the analytical rationale presented. Review is also recommended for the individual who intends to use this revised MDC program for processing SE data.*

A full-scale MMM study of a powered SE work center for the AM32-60 Generator and the NF-2 Light Stand is addressed in Section III. These two pieces of SE were used to exemplify, and further verify the proposed modeling techniques developed during this study. Sensitivity analyses were performed for: (a) maintenance and servicing manpower requirements, (b) SE requirements, and (c)

operational requirements. *Section III is also intended as the user's portion of this report. All of the information required of a user's guide to the proposed modeling techniques is in Section III.*

Section IV outlines the conclusions and insights obtained from this study. It was concluded that SE dispatching activity was directly related to servicing, pickup and delivery, and unscheduled maintenance manhours. The other factors driving SE maintenance are the total number and different types of SE possessed by the work center. A final insight gained was that an SE work center can be modeled as a system in itself and that this system modeling lends itself to MMM application.

II. MODEL DEVELOPMENT, PROGRAMMING AND VERIFICATION

Powered SE Work Center Description

SE branches are composed of three work centers: (a) management, (b) repair and inspection, and (c) servicing/pickup and delivery. Of these three only two, repair and inspection and servicing/pickup and delivery actually perform AFTO Form 349 reportable work in accordance with AF TO-00-20.

The work centers have a mission of satisfying demands for SE initiated by aircraft servicing and unscheduled maintenance. To complete these SE missions, SE is dispatched to parked aircraft and returned again after use. This dispatching activity may involve several types of SE over a 24-hour period.

After an SE mission, the equipment is serviced and operationally checked. If found operative, the equipment is returned to a ready line. If inoperative, it is placed in a waiting for maintenance status until parts and manpower are available for repair. A scheduled maintenance activity called a periodic inspection (PE) is also performed on the SE. This maintenance task is similar to an aircraft phase inspection. A typical PE may consist of 16 man-hours of maintenance performed twice a year on a given piece of equipment.

In order to attempt an MMM effort of an SE work center, the following questions must first be investigated:

1. What are the factors which significantly influence SE failures and likewise SE maintenance activities?

2. Are the data available, or feasibly attainable, for the branching networks which outline the unscheduled maintenance on SE?

3. What are the factors which influence the operational scenario of an SE work center, and are the supporting data available or feasibly attainable?

Criteria Influencing SE Maintenance Requirements

In order to attempt SE modeling, the failure factor(s) that cause SE to fail must be determined. The hypothesis concerning SE is that the flying schedule generates unscheduled SE maintenance. That is, as the sortie rate for a given unit equipment (UE) configuration increases, demands on the SE increase; similarly as demands on SE increase, unscheduled maintenance in the SE branch increases. This hypothesis is supported by two independent investigations.

Figure 2 is a plot of A-7D sorties/month vs. SE unscheduled maintenance man-hours (MMH) expended furing the corresponding month. The data in Figure 2 were obtained from Myrtle Beach AFB. Two unique factors enabled the analysis to be made. First, the A-7D is the major aircraft system present at Myrtle Beach which relates SE maintenance directly to the aircraft's demand for SE (also noted that a linear relationship exists). Secondly, during the months shown, the A-7D experienced a broad range flying schedule.

A further look at the Myrtle Beach SE work center allows the work in the SE branch to be divided into the following five activities.

Activity	Work Generator
Unscheduled Maintenance	Aircraft Sorties
Periodic Inspection	Equipment on Hand
Servicing	Aircraft Sorties
Pickups and Delivery	Sorties/Distances
Supervision	Work Center Size

The work generators were determined through observations of the work center's operations and by discussions with experienced work center personnel.

It is noted that the SE maintenance activities of major interest are generated by aircraft sorties, which adds further verification to the contention that aircraft sortie rate is the prime factor influencing maintenance on SE.

The next task was to establish a relationship between aircraft sorties and SE demands. This consisted of determining an SE demand per sortie for the weapon system of interest and for each type of SE in the work center. Data were obtained from AF Form 864 (Daily Requirement and Dispatch Record) (Figure 3) maintained by Job Control or

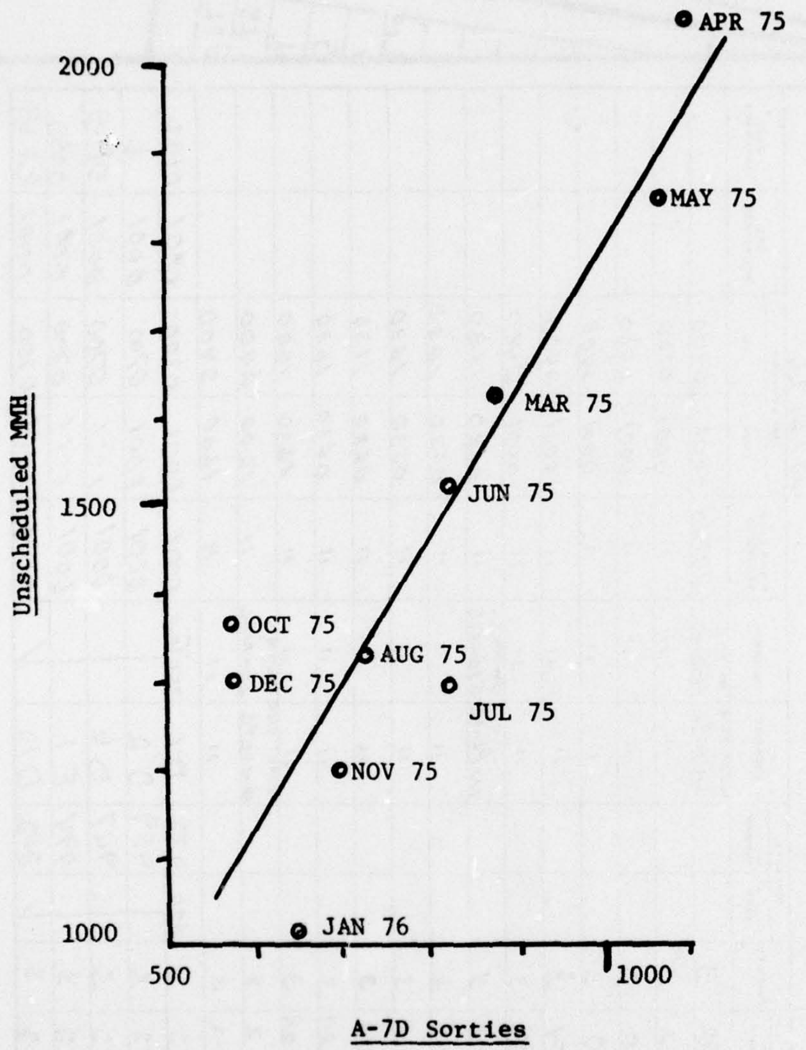
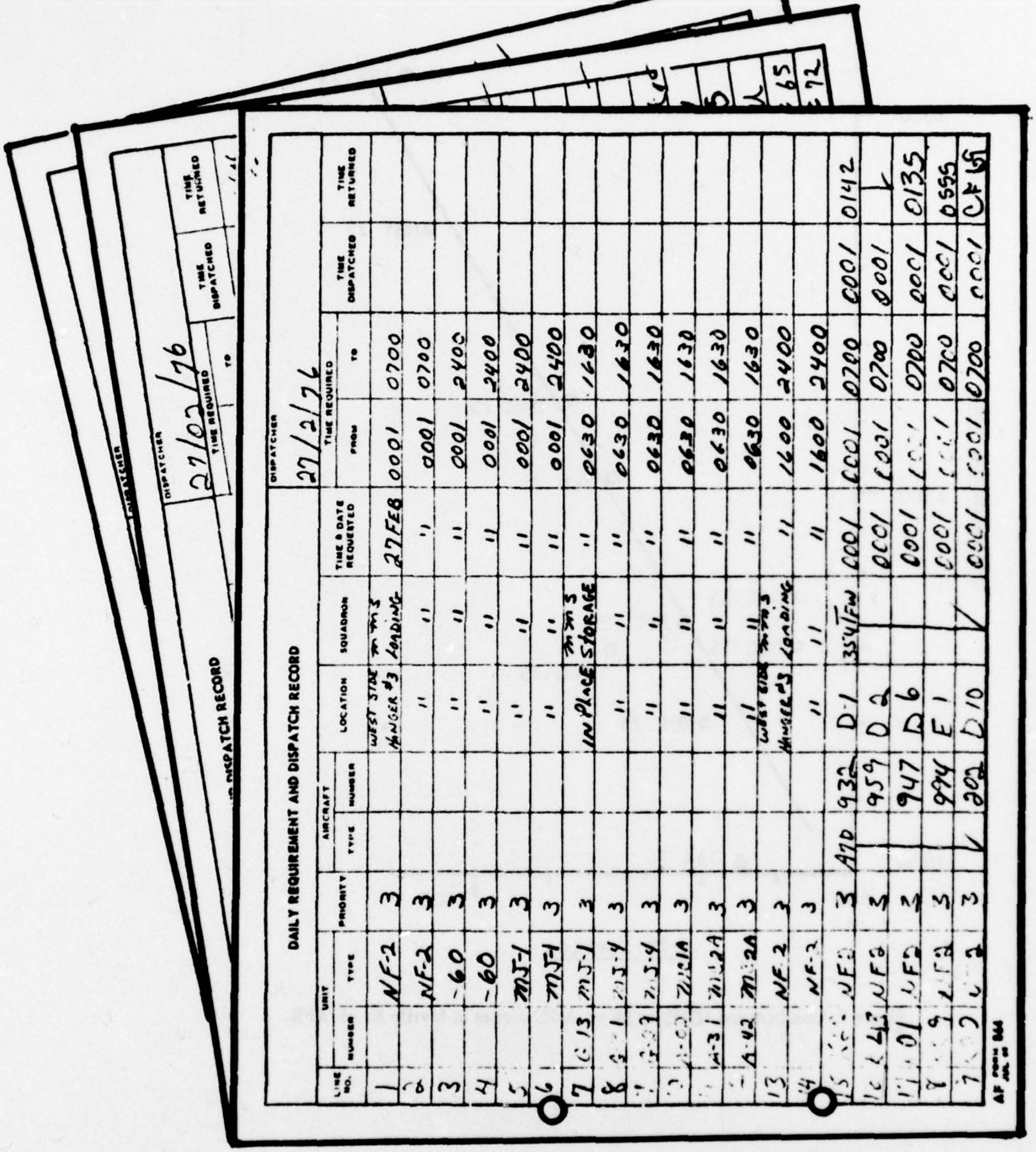


Figure 2. **Unscheduled MMH on SE vs. A-7D sorties at Myrtle Beach AFB.**



DAILY REQUIREMENT AND DISPATCH RECORD

DISPATCHER: 27/2/76

LINE NO.	UNIT NUMBER	UNIT TYPE	PRIORITY	AIRCRAFT TYPE	AIRCRAFT NUMBER	LOCATION	SQUADRON	TIME & DATE REQUESTED	TIME REQUIRED FROM	TIME REQUIRED TO	TIME DISPATCHED	TIME RETURNED
1		NF-2	3			WEST SIDE HANGER #3	MMS LOADING	27FEB	0001	0700		
2		NF-2	3			"	"	"	0001	0700		
3		-60	3			"	"	"	0001	2400		
4		-60	3			"	"	"	0001	2400		
5		MJ-1	3			"	"	"	0001	2400		
6		MJ-1	3			"	"	"	0001	2400		
7	C-13	MJ-1	3			IN PLACE STORAGE	MMS STORAGE	"	0630	1630		
8	[illegible]	MJ-4	3			"	"	"	0630	1630		
[illegible]	[illegible]	MJ-4	3			"	"	"	0630	1630		
[illegible]	[illegible]	MJ-1A	3			"	"	"	0630	1630		
[illegible]	-31	MJ-2A	3			"	"	"	0630	1630		
[illegible]	A-42	MJ-2A	3			"	"	"	0630	1630		
13		NF-2	3			WEST SIDE HANGER #3	MMS LOADING	"	1600	2400		
14		NF-2	3			"	"	"	1600	2400		
15	[illegible]	NF-2	3	A7D	932	D-1	354TFW	0001	0001	0700	0001	0142
16	[illegible]	NF-2	3		959	D-2		0001	0001	0700	0001	
17	[illegible]	NF-2	3		947	D-6		0001	[illegible]	0700	0001	0135
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[illegible]	[illegible]	[illegible]	3		202	D-10		0001	0001	0700	0001	CF [illegible]

AF FORM 864

Figure 3. **AF Form 864.**

the SE Branch, and compared with sorties flown for the same time periods to arrive at these demands rates per sortie. Figure 4 summarizes demands per sortie for various pieces of SE at Myrtle Beach. These demand rates per sortie are quite significant for LCOM networking because they are the same as the occurrence probability that a particular piece of SE will be needed for a sortie.

MDC Program Revision

It was necessary to obtain unscheduled maintenance data on SE equipment in a manner similar to that whereby aircraft unscheduled maintenance data are obtained; and then establish SE component failure rates per sortie. An investigation into the availability of a data base for SE revealed that the maintenance data collection system contained data suitable for networking purposes. The data base, however, is different from aircraft data in several respects. Contained on every ABD69A tape obtained from base level are AFTO Form 349 records of every piece of equipment worked on at this location. To avoid the cumbersomeness of making individual runs on individual equipment types it is necessary to sort SE records into like units before processing through a modified version of the aircraft data base run.

The procedure for distinguishing between various equipment types is in some cases straightforward and in other cases quite complex. For engine or motor driven generators (Federal Stock Class 6115) and munitions handling equipment, identification is straightforward. These equipment types can be identified by the equipment class code (EQ/CL) found in the same position on the AFTO Form 349 records as the mission design series (MDS) for an aircraft (see TO-00-20-2).

All other SE such as hydraulic mules, air conditioners, air compressors, light stands and others are not so easily distinguished. Equipment class codes in this area do little more than separate the equipment into general categories. For example, hydraulic test stands fall under equipment class code AE. This code signifies a class of equipment known as Inspection and Maintenance Equipment. This class includes large work stands, engine stands and hydraulic mules. Obviously this does not help in the construction of a network for a specific type of hydraulic mule.

To identify a particular type of SE such as the TTU-228E hydraulic mule, the National Item Identification Number (NIIN) designator must be utilized. The NIIN designator is a three-digit alphanumeric character that is part of the registration number of every piece of registered SE. An equipment type such as a TTU-228E may have several NIINs that need to be obtained so that all like equipment can be processed together.

It is necessary to obtain from the work center a list of all NIINs that pertain to the particular piece of SE in question. Figure 5 gives the NIINs for all the TTU-228E Hydraulic Mules, and for all the NF-2 Light Stands at Myrtle Beach AFB. This is necessary if maintenance data are to be processed on these pieces of SE. This list may be compiled from information obtained from the TO 35-1 series, *Application of AF Registration Numbers*; or it may be obtained from the work card for the particular piece of equipment at the work center.

Besides the difference in the use of equipment class codes, there are some other differences in the records. The most obvious difference is the work unit code scheme. All SE equipment work unit codes can be found in either TO-0025-06-2-2 or TO 35C2-3-1-06. The work unit codes are 5-digit alphanumeric codes. Because the first two characters are always alpha, the data base programs had to be modified to accommodate this difference.

Other codes contained on the record are similar to codes utilized by aircraft maintenance. The How Malfunctioned codes are identical to the codes utilized for aircraft maintenance. Action Taken codes are also identical. The Type Maintenance and When Discovered codes are slightly different. This difference in these two codes must be accounted for to make proper modification to the data base processing programs.

To accommodate the difference in the SE data base some modifications of the MDC program were required. The entire listings for all programs, unique or modified for SE processing, are contained in the appendices. The major changes to the data base processing scheme was the introduction of the pre-processor, modification to GETDATA, now GETAGE, and the modification of COMBINE, now COMBAGE.

The pre-processor is a new program required to select and sort only those pieces of equipment required for networking. The pre-processor provides the user with the ability to select by card input those equipment class codes and NIIN designators desired. The pre-processor then inputs these separate SE files into the data base programs to be processed sequentially by rewinding the data base program tapes while files are resident in core.

The GETAGE program is a result of modifications made to accommodate the differences in

Type	Name	A-7D Demand Rate/Sortie
AM32-60	Generator	1.27
NF-2	Light Stand	1.06
TTV228E	Hydraulic Mule	.045
MC1	Air Compressor (Hi Pac)	.090
MC2A	Air Compressor (Lo Pac)	.080
MJ-1	Bomb Lift Truck	.080
MB-1	Cabin Leakage Tester	.032

Figure 4. **Powered support equipment demand rate/sortie.**

DLD DLU FQ3 FRC FTK	TTU-228E HYDRAULIC MULE
LAA LAB LAC LAD LAE LAF LAG LAH LAI LAJ LAK LAL LAM LAQ	NF-2 LIGHT STANDS

Figure 5. **NIIN equipment.**

the data base as discussed previously. The addition of a service file was the major change with respect to the user. Because most maintenance in the SE branch is done within a relatively small work area, the general support codes (01000 to 09000) take on more significant meaning. Such codes as 03114 (Periodic) provide meaningful information to those concerned with SE maintenance. Thus, these general support codes have been included in the processing runs.

Adaptability of SE Work Centers for the LCOM Models

The first modeling technique outlined in Section I, whereby only the SE work center is simulated, requires an operational scenario for the SE work center. That is, a description of SE missions, duration, and departure times must be estimated. AF Form 864 (see Figure 3) is a source for such data. Figure 6 is a cumulative probability distribution for the dispatch of AM32-60s at Myrtle Beach during the spring of 1976. Figure 6 was produced from data obtained from AF Forms 864, other such illustrations for other pieces of SE could likewise be produced. Such distributions are input into the LCOM model to generate departure times.

Figure 7 is a probability distribution of the AM32-60 dispatch durations. This distribution was also plotted from data obtained from AF Forms 864, and is needed as LCOM input.

The data depicted in Figures 6 and 7 are needed only for simulation of an SE work center per the *first approach* outlined in Section I. In such cases, dummy sorties are generated which then generate demands for various types of SE. These demands would reflect the dispatch times and durations depicted in Figures 6 and 7.

If the SE maintenance networks are incorporated into the parent weapon system's LCOM model in accordance with the *second approach*, dispatch times and durations for SE are automatically generated.

III. PREDICTING POWERED SE REQUIREMENTS VS. MANPOWER REQUIREMENTS AND OPERATIONAL REQUIREMENTS FOR THE A-7D

A full-scale MMM simulation of a powered SE work center for the AM32-60 Generator and the NF-2 Light Stand is addressed in this section. These two pieces of SE are used to exemplify and further verify the proposed modeling techniques outlined in Section II.

The scenario used reflects the support of a 72 UE A-7D wing flying about 1,000 hours per month. To support this operation and deployment requirement, 24 AM32-60s (–60) were on hand. The NF-2 was selected because it was utilized almost as heavily as the –60. The NF-2 provides night lighting and 120 volts AC power for support of flight line maintenance.

Both approaches as described in Section I, paragraph B are exemplified. In order to conduct an LCOM study using either the *first approach* or the *second approach*, all information that would be required to process the original MDC program is needed. (See Section IV of AFHRL-TR-74-97(III)). In addition the following information is needed:

1. Support equipment work unit code manuals.

2. The equipment class code for SE pieces that are of Federal Stock Class 6115 (motor driven generators or munitions handling equipment). (See TO-00-20-2 or TO 35C2-3-1-06.)

3. The NIIN designator for pieces of SE other than those classified as Federal Stock Class 6115. (See TO 35-1), *Application of Air Force Registration Numbers.*) The NIINs may also be obtained from the work card for the particular piece of equipment at the work center.

4. A set of completed AF Forms 864 (Figure 3) for the 6-month period of interest. These forms are obtained from Job Control or the SE Branch at the operational unit of interest.

5. The unscheduled maintenance networks are obtained by processing the SE data obtained from the ABD64-A tapes through the MDCAGE programs in order to obtain initial insight and information for these networks. These networks are then verified by discussion with experienced maintenance personnel in the field.

Paragraph A and Figures 8 through 10b of this section apply to the *first approach*. Paragraphs B and C and the rest of the illustrations apply to both the *first approach* and the *second approach*.

Main Dispatch Network for SE

Dispatch times and dispatch duration distributions, means, and standard deviations were developed from completed AF Forms 864 (Figure 3). As mentioned in Section II, Figures 6 and 7 present these data. In the dispatching network, the –60 and the NF-2 are "used" based upon their average utilization (or dispatch) time, not operating time.

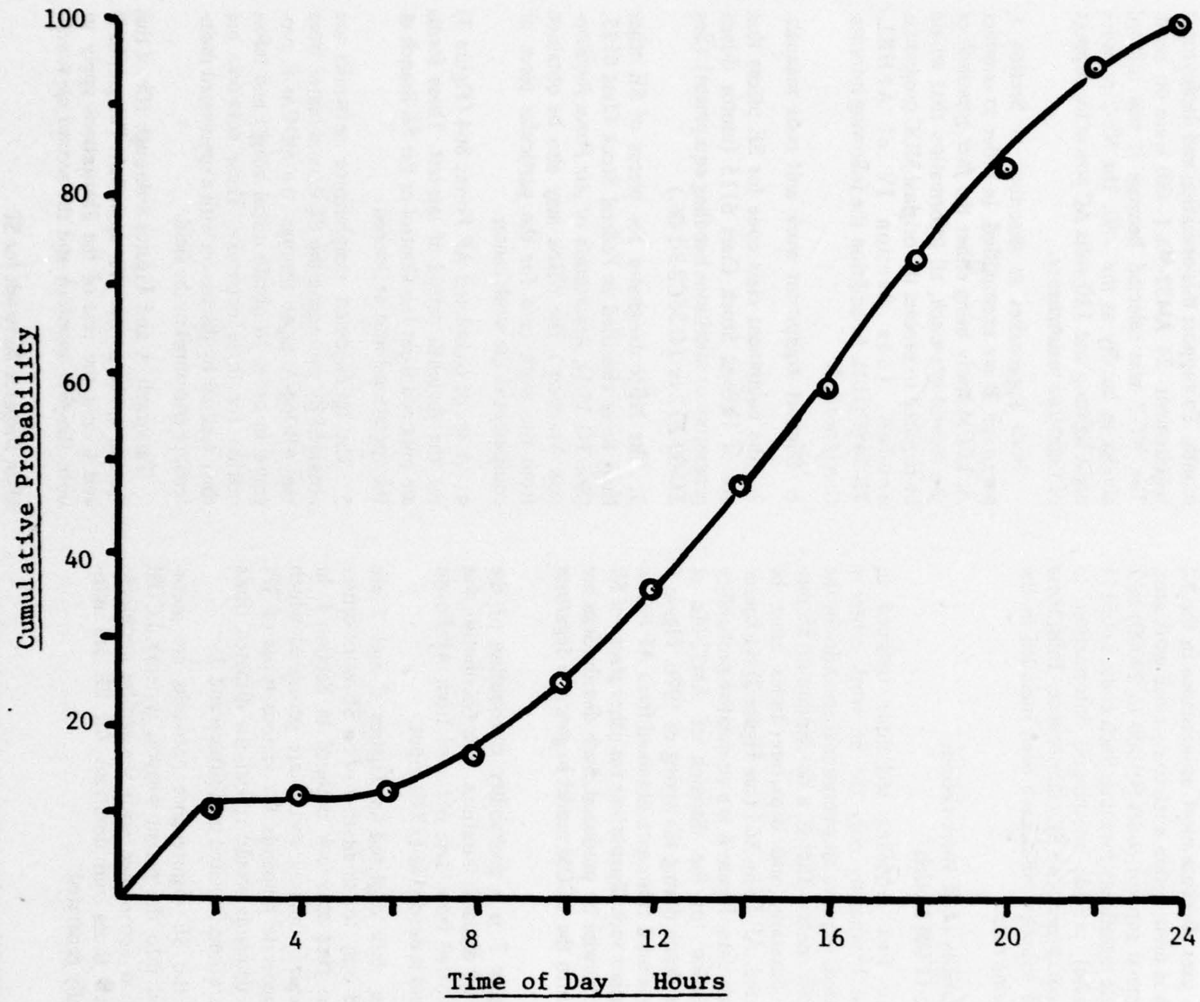

Figure 6. **Cumulative probability distribution of AM32-60 dispatch times Myrtle Beach AFB, spring 1976.**

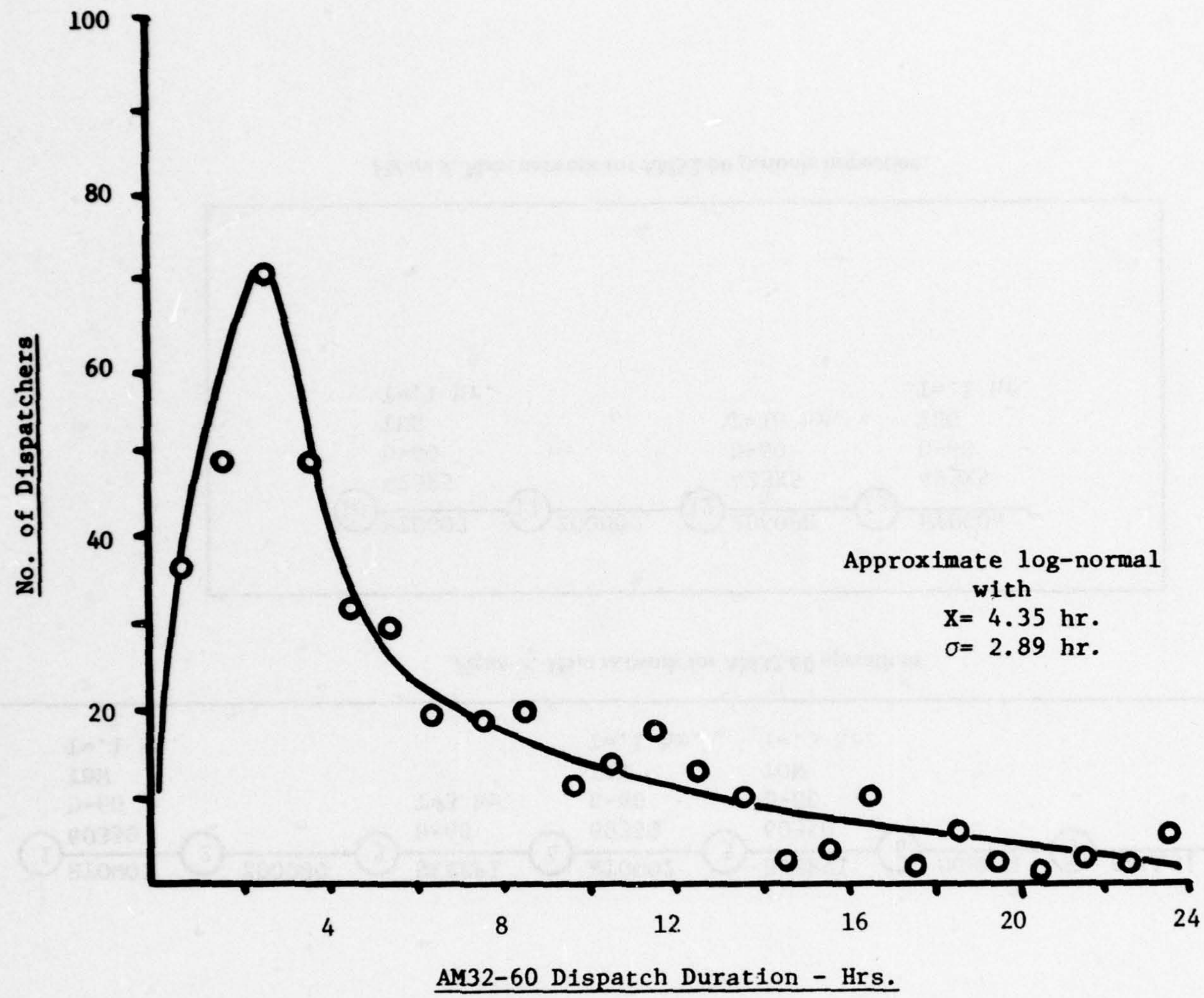

Figure 7. **Probability distribution of AM32-60 dispatch duration-hours, Myrtle Beach AFB, spring 1976.**

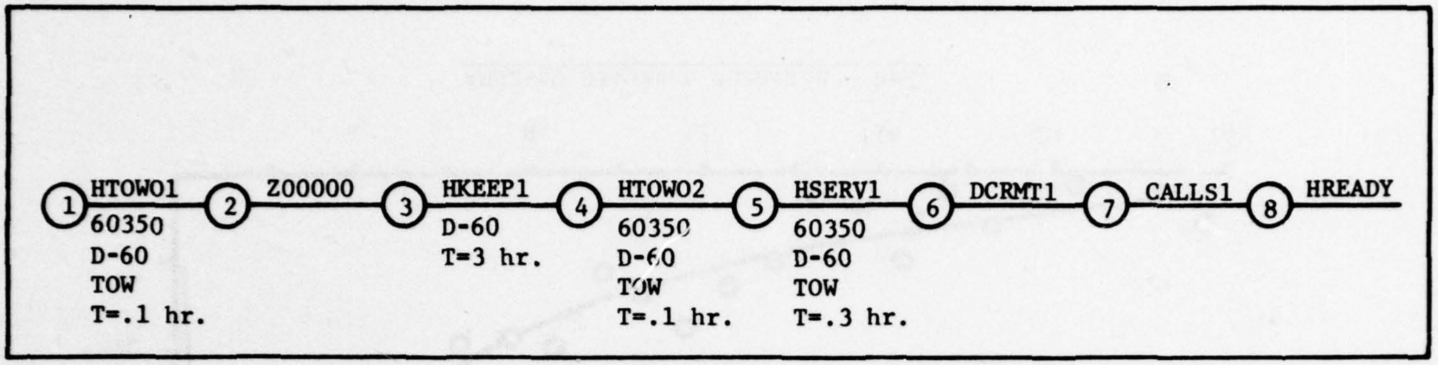

Figure 8. **Main network for AM32-60 operations.**

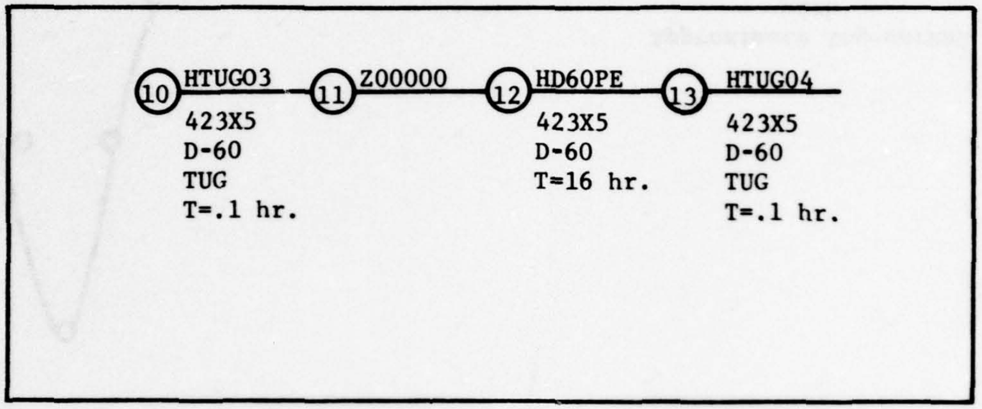

Figure 9. **Main network for AM32-60 periodic inspection.**

```
                           H          00010 AM32-60(D60) MAIN NETWORK
J0001 HTOW01  J0002 D          00010 31     1   C 1D60   1TOW   1603X0
J0002 Z00000  J0003 S          00010 11
J0003 HKEEP1  J0004 D          00010 31    30 30L 1D60
J0004 HTOW02  J0005 D          00010 31     1   C 1D60   1TOW   1603X0
J0005 HSERV1  J0006 D          00010 31     3   C 1D60   1TOW   1603X0
J0006 DCRMT1  J0007 D          00010 31
J0007 CALLS1  J0008 C          00010 31
J0008 HREADY        D          00010 31
                    H          00010 AM32 60 PERIODIC INSPECTION(PE)
J0010 HTVG03  J0011 D          00010 31     1   C 1D60   1TUG   1423X5
J0011 Z00000  J0012 S          00010 11
J0012 HD60PE  J0013 D          00010 31   160 29L 1D60   1423X5
J0013 HTUG04        D          00010 31     1   C 1D60   1423X5 1TUG
```

Figure 10a. **LCOM Form 11 (extended) listing for AM32-60 generator (main network and periodic inspection).**

```
                    H          00010     NF-2 MAIN NETWORK
J0020 HTOW04  J0021 D          00010 31     1   C 1NF2   1TOW   1603X0
J0021 Z00000  J0023 S          00010 11
J0023 HKEEP2  J0024 D          00010 31    30 30L 1NF2
J0024 HTOW05  J0025 D          00010 31     1   C 1NF2   1TOW   1603X0
J0025 HSERV2  J0026 D          00010 31     1   C 1NF2   1TOW   1603X0
J0026 DCRMT2  J0027 D          00010 31
J0027 CALLS1  J0028 C          00010 31
J0028 HREAD2        D          00010 31
                    H          00010     NF-2 PERIODIC
J0030 HTOW06  J0031 D          00010 31     1   C 1NF2   1TUG   1423X5
J0031 Z00000  J0032 D          00010 11
J0032 HNF2PE  J0034 D          00010 31    90 29L 1NF2   1423X5
J0034 HTOW07        D          00010 31     1   C 1NF2   1TUG   1423X5
```

Figure 10b. **LCOM Form 11 (extended) listing for NF-2 light stand (main network and periodic inspection).**

Figures 8 and 9 outline the main dispatch networks for the AM32-60. The networks for the NF-2 are analogous. Figure 8 depicts a dummy sortie rate that generates requirements for the –60. Figure 9 presents an operational network for a dummy sortie that is driven by the –60 periodic inspection schedule. Note that there is a KEEP task in the main networks. This task represents the dispatch duration for the piece of SE equipment demanded. This duration is a random variable that follows the distribution outlined in Figure 7, and it also has the distribution parameters indicated in Figure 7.

The TOW tasks in Figures 8 and 9 are self-explanatory – so is the service task (SERV1). The DCRMT tasks decrement all of the failure clocks on the various significant components on the various pieces of SE considered. The clocks were decremented right after the SERV tasks because the investigations into the work center operations revealed that essentially all unscheduled maintenance tasks are discovered here. This is because essentially none of the SE failures would prevent the particular piece of SE from completing its mission. That is, it could go ahead and complete its mission with a faulty or "less than 100%" component, and the malfunction or damaged part would not be discovered or corrected until the mission was completed and the SE was being serviced. Also, should the piece of SE become inoperative during its mission performance (e.g., run out of gas), a second identical piece is dispatched so rapidly (one to five minutes) that the "SE mission" is essentially not delayed. These extra dispatches are accounted for by the demand per sortie rates that are greater than one in Figure 4.

CALLS1 checks to see if there has been a failure since the last dispatch (or sortie). If so, actions are completed in accordance with the appropriate networks in order to repair the component that failed. The READY task places the SE piece back in the operationally ready pool.

Figures 10a and 10b are listings from LCOM Form 11 (extended). These forms are used to describe the networks for input to the PHASE I model. Figure 10a represents the –60 operational networks and Figure 10b represents the NF-2 main operational networks.

Unscheduled Maintenance Tasks Networks for SE

The primary computer run efforts associated with the MDC program are TRN9T07, BASIC RUN, and PRINTOUT. Analogous efforts are now associated with the revised MDC program (MDCAGE). They are TRNAGE, BASIC AGE, and PRINTAGE. In addition, a new program AGEPREP, was needed to account for the unique characteristics the SE data have for aircraft data. The AGEPREP run was incorporated into the TRNAGE effort. Pertinent files are described in Figures 11a, 11b, and 11c.

The ABD64-A tapes are processed through the MDCAGE programs in somewhat the same manner that they are processed through the original MDC programs. Figure 12 shows a typical deck setup to process the TRNAGE run. Figure 13 further clarifies this setup routine. The nine track ABD64-A tapes are used as input. Also NIINs and the EQ/CL are specified at this time and inputted into TRNAGE. The particular types of SE whose maintenance data are to be processed are indicated by their EQ/CL or their NIINs.

The EQ/CL is identical for all pieces of SE which are of the same type. (e.g., all AM32-60s have EQ/CLs of BJ) (Columns 1 and 2 of Figure 12). The NIIN is unique for each piece of SE, therefore, "dummy" EQ/CLs are assigned to those types of SE that must be identified by their NIINs in order to group all individual pieces of one type of SE into one group. Consider Figure 12 and Figure 5 and note that all TTU-28E Hydraulic Mules are grouped under a "dummy" EQ/CL of OA (columns 4 and 5 of Figure 12 also indicates that all NF-2 Light Stands were grouped under an EQ/CL of OG; and that all maintenance data on the UJ-1 Bomblift Truck (whose EQ/CL is YK), all maintenance data on the Hydraulic Mule, on the Light Stand, and on the AM32-60 will be processed for this computer run effort.

Figure 14 shows a typical deck set-up to process BASIC AGE and Figure 15 further clarifies this set-up routine. Note that BASIC AGE is processed more than one time per run, (4 times in the example) in order to process more than one piece of SE per run. Figures 16a and 16b depict the input data for BASIC AGE and PRINTAGE. Figures 17 and 18 deal with PRINTAGE in an analogous manner.

Figures 19 and 20 present typical output from the revised MDC program. This output results in the data needed for the unscheduled maintenance on SE; or more specifically, the unscheduled maintenance on various components of the SE. Figure 19 is the on-equipment file, and Figure 20 is the off-equipment file.

Figure 21 depicts the unscheduled maintenance network for the chasis on the –60. Data for this network were obtained from Figures 19 and 20.

FILE-NAME(S)	TYPE-FILE	USAGE
ABD64A	Data 9-TRK Magnetic Tape	INPUT
BTRNAGE	FORTRAN Binary Permanent File	Converts 9-TRK Tape To Create Data File T7DATA
TYPE	Data (Acft Identifier)	INPUT
T7DATA	System Data Temporary Permanent File LFN=TAPE 7	Contains Acft Elimination Data - Purge As Soon As Possible
BAGEPREP	FORTRAN Binary Permanent File	Create Final OUTPUT for TRNAGE
EQPCLS	Data System File	INPUT
MFLIN, MSUF1 MSUF2	Data System File	INPUT
SORTMRG	Utility	Sorts Records Dependent on INPUT Sort Directives
LIMEQPCLASAGE	Data Permanent File	OUTPUT From TRNAGE INPUT To BASIC AGE

Figure 11a. **TRNAGE files.**

FILE-NAME	TYPE-FILE	USAGE
BGETAGE	FORTRAN Binary Permanent File	
LIMEQCLASAGE	Data Permanent File LFN=Tape 7	INPUT
NOMAF1	Data Permanent File LFN=Tape 40	INPUT (AFSC Nomen)
NOMAF2	Data Permanent File LFN=Tape 50	INPUT (AFSC Nomen)
SORT MRG	Utility	Sorts Records Dependent on INPUT Sort Directives
ADJUST	FORTRAN Binary LFN=Adjust	
BAGEBIN	FORTRAN Binary Permanent File	
COLLECT	FORTRAN Binary Permanent File	
BREPAGE	FORTRAN Binary Permanent File	
BTHRAGE	FORTRAN Binary Permanent File	
AGEQCLAS	Data Permanent File LFN-Tape 19	OUTPUT From Part 2 INPUT To Part 3

Figure 11b. **BASIC AGE files.**

FILE-NAME	TYPE-NAME	USAGE
AGEQCLAS	Data Permanent File LFN=Tape 8	INPUT
BPRTAGE	FORTRAN Binary Permanent File	
NOMAF2	Data Permanent File LFN=Tape 10	INPUT (AFSC Nomen)

Figure 11c. **PRINTAGE files.**

```
Z1VBH,STCSB,T1000,CM100000,ID2000,NT1. H710375/53771
COMMENT. INTERCOM BATCH **NO DECK
REQUEST,TAPE7,*PF.
ATTACH,BT,BTRNAGE,CY=2.
VSN,TAPE8=L00738/L00827/L00828.
REQUEST,TAPE8,NT,S,NORING.
BT.
CATALOG,TAPE7,T7DATA,CY=1,RP=999.
RETURN,TAPE7,TAPE8.
LIMIT,3072.
COPYBR,INPUT,TAPE20.
REWIND,TAPE20.
REQUEST,TAPE7,*PF.
ATTACH,BA,BAGEPREP,CY=1.
ATTACH,TAPE27,T7DATA,CY=1.
REWIND,TAPE27.
REWIND,TAPE8,TAPE7.
RFL,70000.
BA.
FILE,TAPE8,BT=C,RT=Z,FL=71,FO=SQ.
FILE,TAPE7,BT=C,RT=Z,FL=71,FO=SQ.
LDSET,FILES=TAPE8/TAPE7.
SORTMRG.
CATALOG,TAPE7,LIMEQPCLASAGE,CY=1,RP=999.
RETURN,TAPE7.
*EOR
FA  <-- input
*EOR
DLD0A  \
DLU0A   |
FQ30A   |
FRC0A   |
FTK0A   |
LAA06   |
LAB06   |
LAC06   |
LAD06   |
LAE06    > input
LAF06   |
LAG06   |
LAH06   |
LAI06   |
LAJ06   |
LAK06   |
LAL06   |
LAM06   |
LAQ06  /
*EOR
BJ \
YK / input
*EOR
SORT
FILE,INPUT=TAPE8(R),OUTPUT=TAPE7(R)
FIELD,LSUF(70,2,DISPLAY)
KEY,LSUF(A,DISPLAY)
END
*EOF
```

Figure 12. **TRNAGE control cards and input deck.**

CARD	COLUMN	FORMAT	VARIABLE	DESCRIPTION
*1 unlimited	1-3	R3	MFIIN	Indicates data to be kept for processing FIIN designator for piece of equipment
**	4	R1	MSUF1	1st & 2nd characters of assigned dummy equipment class code.
	5	R1	MSUF2	
2				7/8/9 EOR card
3 N 1 N 25	1	R1	EQPCLS1(N)	Indicates data to be processed thru the SE data bank series. First and second character of real equipment class codes.
	2	R1	EQPCLS2(N)	

* This deck is to be in sorted order based on the MFIIN where letters come before numbers.

** A maximum of 4 different equipment class codes (either assigned "dummy" codes or real ones) is allowed.

Figure 13. **Program TRNAGE setup.**

```
Z1AG,STCSB,T777,ID500,CM70000. H710375 HICKS/53771
COMMENT. INTERCOM BATCH JOB ** NO DECK***
LIMIT,3072.
ATTACH,GA,BGETAGE,CY=10.
ATTACH,TAPE7,LIMEQPCLASAGE,CY=1.
ATTACH,TAPE40,NOMAF1,CY=1.
ATTACH,TAPE50,NOMAF2,CY=1.
REWIND,TAPE7,TAPE40,TAPE50.
FILE,TAPE1,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE4,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE7,FO=SQ,BT=C,RT=Z,FL=71.
LDSET,FILES=TAPE7/TAPE1.
GA.
REWIND,TAPE40.
REWIND(TAPE1)
LDSET(FILES=TAPE1/TAPE4)
SORTMRG(6C)
REWIND,TAPE4.
ATTACH,ADJUST,ADJUST,CY=1.
LDSET,PRESET=ZERO.
ADJUST.
RETURN,ADJUST.
REWIND,TAPE1,TAPE2.
FILE,TAPE1,FO=SQ,BT=C,RT=Z,FL=150.
ATTACH,AB,BAGEBIN,CY=10.
AB.
REWIND,TAPE50.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,COLLECT,COLLECT,CY=1.
LDSET,PRESET=ZERO.
COLLECT.
RETURN,COLLECT.
REWIND(TAPE1,TAPE2)
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=41.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
ATTACH,BR,BREPAGE,CY=1.
BR.
REWIND,TAPE8,TAPE9,TAPE10,TAPE12.
FILE,TAPE12,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE2,FO=SQ,BT=C,RT=Z,FL=41.
LDSET(FILES=TAPE1/TAPE2)
SORTMRG(6C)
REWIND(TAPE1,TAPE2)
REWIND,BR.
LDSET,PRESET=ZERO.
BR.
REWIND,TAPE8,TAPE9,TAPE10,TAPE12.
FILE,TAPE12,FO=SQ,BT=C,RT=Z,FL=150.
FILE,TAPE3,FO=SQ,BT=C,RT=Z,FL=33.
LDSET(FILES=TAPE3/TAPE12)
SORTMRG(6C)
REWIND,TAPE3,TAPE12.
COPYCF,TAPE3,TAPE19.
REWIND,TAPE3.
REWIND,TH.
LDSET,PRESET=ZERO.
TH.
REWIND,TAPE1,TAPE2,TAPE3,TAPE4,TAPE8,TAPE9,TAPE10,TAPE11,TAPE17.
CATALOG,TAPE19,AGEQCLAS,CY=1,RP=999.
RETURN,THRELVL.
RETURN,TAPE8,TAPE9,TAPE10,TAPE19.
EXIT.
REWIND,TAPE4.
*EOR
```

Repeat this sequence of cards for each time BASIC GETAGE processes an SE type.

Figure 14. **BASIC AGE control cards and input.**

```
BJ1516              5714
000
*EOR
SORT(1,1,45,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE4,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,29)
RECORD(I,U,45)
END
*EOR
  500  600  600
*EOR
SORT(1,1,33,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(37,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789 )
KEY(A,C,1,17)
RECORD(I,U,33)
END
*EOR
SORT(1,1,41,,4)
FILE(TAPE1,S,D,,R,N)
FILE(TAPE2,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#[ ]%"+!&'?
                                                          <>@\↑;)
KEY(A,C,1,15)
RECORD(I,U,41)
END
*EOR
SORT(1,1,33,,4)
FILE(TAPE12,S,D,,R,N)
FILE(TAPE3,O,D,,R,N)
SEQ(63 ,ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/()$= ,.#[ ]%"+!&'?
                                                          <>@\↑;)
KEY(A,C,1,5)
RECORD(I,U,33)
END
*EOR
```

NOTE: This sequence of cards should be repeated for each time BASIC AGE is processed with only the first two characters of the first card changed to reflect the EQ/CL being processed.

Figure 14 (*Continued*)

CARD	COLUMN	FORMAT	VARIABLE	DESCRIPTION
1	1-2	R2	MDS	Equipment class code (real or dummy) for data being processed.
Additional input which is the same as for GETDATA				
1	1-5	I5	LIMONEQ	Upper limit for the on-equipment file of the ratio of elapsed time (in 1/10 hr. units) and maintenance actions
	6-10	I5	LIMOFEQ	Same as in COMBINE
	11-15	I5	LIMSERV	Upper limit for the service file of the ratio of elapsed time and maintenance actions.
Repeat this sequence of card inputs for the number of equipment class codes being processed.				

Figure 15. **BASIC AGE setup.**

```
23110 FMS MACHINE SHOP           531X0
23120 FMS METAL PROCESSING       532X0
23130 FMS STRUCTURAL REPAIR      534X0
23410 FMS AGE REPAIR             421R3
23420 FMS AGE SERVICING          421S3
23330 FMS ELECTRICAL             423X0
```

Figure 16a. **BASIC AGE input.**

```
421R3 FM FMS AGE REPAIR
421S3 FM FMS AGE SERVICING
423X0 FM ELECTRICAL
531X0 FM MACHINE SHOP
532X0 FM METAL PROCESSING
534X0 FM STRUCTURAL REPAIR
```

Figure 16b. **PRINTAGE input.**

CARD	COLUMN	FORMAT	VARIABLE	DESCRIPTION
1	23	R1	IEQPCL1	1st and 2nd characters of the equipment class code for the SE being processed. If a "dummy" code (i.e., EQPCL1 is a number), then only the FIINs are printed.
	25-28	1X,R3	IFIIN (I)	List of FIINs where $0 \leq I \leq 14$. This is for printout purposes only, when a dummy equipment code is given in Columns 23-24. If I > 14, place ETC in last position. The first character of each 4 col. block is not read, so the 3 characters FIIN must be right justified.

NOTE: Be sure to include cards for on-engine file although the data bank is a null file.

Figure 17. **Program printage setup.**

```
Z1PA,T900,CM75000,STCSB,ID900. H710375 HICKS 53771
COMMENT. INTERCOM BATCH *** NO DECK
ATTACH,TAPE8,AGEQCLAS,CY=3.
COPYCF,TAPE8,TAPE9.
REWIND,TAPE9.
ATTACH,TAPE10,NOMAF2,CY=1.
REWIND,TAPE10.
ATTACH,BP,BPRTAGE,CY=1.
BP,PL=40000.
REWIND,TAPE10,BP,TAPE9.
COPYCF,TAPE8,TAPE9.
REWIND,TAPE9.
BP,PL=40000.
REWIND,TAPE10,BP,TAPE9.
COPYCF,TAPE8,TAPE9.
REWIND,TAPE9.
BP,PL=40000.
REWIND,TAPE10,BP,TAPE9.
COPYCF,TAPE8,TAPE9.
REWIND,TAPE9.
BP,PL=40000.
*EOR
```

```
5714.00     10519.0  150J
(R5,R8/(F8.1,5(I6,F6.1)))
5714.00     10519.0  450J
(R5,R8/(F8.1,5(I6,F6.1)))
5714.00     10519.0  250J
(R5,R8,F8.1,4(I6,F6.1)/(F8.1,4(I6,F6.1),F8.1,4(I6,F6.1)))
5714.00     10519.0  350J
(R5,R8/(F8.1,5(I6,F6.1)))  <EOR card
5714.00     10519.0  15YK
(R5,R8/(F8.1,5(I6,F6.1)))
5714.00     10519.0  45YK
(R5,R8/(F8.1,5(I6,F5.1)))
5714.00     10519.0  25YK
(R5,R8,F8.1,4(I6,F6.1)/(F8.1,4(I6,F6.1),F8.1,4(I6,F6.1)))      input
5714.00     10519.0  35YK
(R5,R8/(F8.1,5(I6,F5.1)))
5714.00     10519.0  150A DLD DLU FO3 FRC FTK  <EOR card
(R5,R8/(F8.1,5(I6,F6.1)))
5714.00     10519.0  450A DLD DLU FO3 FRC FTK
(R5,R8/(F8.1,5(I6,F6.1)))
5714.00     10519.0  250A DLD DLU FO3 FRC FTK
(R5,R8,F8.1,4(I6,F6.1)/(F8.1,4(I6,F6.1),F8.1,4(I6,F6.1)))
5714.00     10519.0  350A DLD DLU FO3 FRC FTK
(R5,R8/(F8.1,5(I6,F6.1)))                    <EOR card
5714.00     10519.0  150G LAA LAB LAC LAD LAE LAF LAG LAH LAI LAJ LAK LAL LAM LAQ
(R5,R8/(F8.1,5(I6,F6.1)))
5714.00     10519.0  450G LAA LAB LAC LAD LAE LAF LAG LAH LAI LAJ LAK LAL LAM LAQ
(R5,R8/(F8.1,5(I6,F6.1)))
5714.00     10519.0  250G LAA LAB LAC LAD LAE LAF LAG LAH LAI LAJ LAK LAL LAM LAQ
(R5,R8,F8.1,4(I6,F6.1)/(F8.1,4(I6,F6.1),F8.1,4(I6,F6.1)))
5714.00     10519.0  350G LAA LAB LAC LAD LAE LAF LAG LAH LAI LAJ LAK LAL LAM LAQ
(R5,R8/(F8.1,5(I6,F6.1)))
```

Figure 18. **PRINTAGE control cards and input.**

```
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 1   1.6 HR    5 R ACTIONS    93.2 MMH    16.85 MMH/1000FH
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 2   2.3 HR    7 R ACTIONS
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 3   1.7 HR    7 R ACTIONS
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 4    .5 HR    9 R ACTIONS
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 1    .3 HR    2 V ACTIONS      .6 MMH      .11 MMH/1000FH
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 1   7.1 HR    1 T ACTIONS    22.2 MMH     3.82 MMH/1000FH
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 2    .9 HR    1 T ACTIONS
WUC=AAC    AFSC=  421X3   NOM= FM AGE                          CREW= 3  24.3 HR    2 T ACTIONS
                  FOR WUC AAC  ,AFSC    421X3,MEAN M JOB TIME=  2.6, MEAN R JOB TIME=  1.8

WUC=AAC    AFSC=  423X0   NOM= FM ELECTRICAL                   CREW= 1   2.0 HR    1 M ACTIONS     2.0 MMH      .34 MMH/1000FH
                  FOR WUC AAC  ,AFSC    423X0,MEAN M JOB TIME=  2.0, MEAN R JOB TIME=  0.0

WUC=AAC    AFSC=  534X0   NOM= FM STRUCTURAL REPAIR            CREW= 2   1.6 HR    1 M ACTIONS     3.2 MMH      .55 MMH/1000FH
                  FOR WUC AAC  ,AFSC    534X0,MEAN M JOB TIME=  1.6, MEAN R JOB TIME=  0.0
                  WUC=AAC     UNIT MSBMA=    282.    OPA=   1

********************
                  WUC= AAC      AFSC     R ELAP     RMA     RPROB     M ELAP     MMA     MPROB
                                421X3     1.45       28      .78       2.20       6       .17
                                423X0     0.00       0      0.00       2.00       1       .03   .23
                                534X0     0.00       0      0.00       1.60       1       .03

WUC=AADDF  AFSC=  421X3   NOM= FM AGE                          CREW= 1   2.7 HR    2 M ACTIONS     5.3 MMH      .91 MMH/1000FH

WUC=AADD   AFSC=  421X3   NOM= FM AGE                          CREW= 1   2.7 HR    2 M ACTIONS     5.3 MMH      .91 MMH/1000FH
                  WUC=AADD    UNIT MSBMA=   3629.    OPA=   1

**********
                  WUC= AADD     AFSC     R ELAP     RMA     RPROB     M ELAP     MMA     MPROB
                                421X3     0.00       0      0.00       2.65       2      1.00

WUC=AADEG  AFSC=  421X3   NOM= FM AGE                          CREW= 1    .5 HR    1 M ACTIONS      .5 MMH      .09 MMH/1000FH

WUC=AADE   AFSC=  421X3   NOM= FM AGE                          CREW= 1    .5 HR    1 M ACTIONS      .5 MMH      .09 MMH/1000FH
                  WUC=AADE    UNIT MSBMA=   7257.    OPA=   1

**********
                  WUC= AADE     AFSC     R ELAP     RMA     RPROB     M ELAP     MMA     MPROB
                                421X3     0.09       0      0.00        .50       1      1.00

WUC=AADGD  AFSC=  421X3   NOM= FM AGE                          CREW= 1   1.5 HR    1 R ACTIONS     1.5 MMH      .25 MMH/1000FH

WUC=AADGE  AFSC=  421X3   NOM= FM AGE                          CREW= 1   3.5 HR    1 M ACTIONS     3.5 MMH      .60 MMH/1000FH
WUC=AADGE  AFSC=  421X3   NOM= FM AGE                          CREW= 1   1.5 HR    1 R ACTIONS    13.5 MMH     2.33 MMH/1000FH
WUC=AADGE  AFSC=  421X3   NOM= FM AGE                          CREW= 3   4.0 HR    1 R ACTIONS

WUC=AADGJ  AFSC=  421X3   NOM= FM AGE                          CREW= 1   1.0 HR    1 M ACTIONS     5.5 MMH      .95 MMH/1000FH
WUC=AADGJ  AFSC=  421X3   NOM= FM AGE                          CREW= 3   1.5 HR    1 M ACTIONS
WUC=AADGJ  AFSC=  421X3   NOM= FM AGE                          CREW= 1   1.5 HR    1 R ACTIONS     1.5 MMH      .25 MMH/1000FH
```

Figure 19. **On-equipment file for AM32-60.**

```
WUC=AACFL   AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 1   5.0 HR    1 N5 ACTIONS      5.0 MMH        .05 MMH/1000FH
              FOR WUC=AACFL   REMOVALS=  2   ADJUSTED COUNT=  2  Q FACTOR=1.000   TOTAL IN SHOP=   1.   G PROB NO SHOP=  .0001
              WUC=AACFL   UNIT MSBF=  7257.   G PROB= .00014   OPA=  1

WUC=AACF    AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 1   3.0 HR    2 N5 ACTIONS      5.9 MMH       1.02 MMH/1000FH
              FOR WUC=AACF    REMOVALS=  6   ADJUSTED COUNT=  6  Q FACTOR=1.000   TOTAL IN SHOP=   2.   G PROB NO SHOP=  .0005
              WUC=AACF    UNIT MSBF=  3629.   G PROB= .00028   OPA=  1

*****IF REMOVED ITEM REPLACED FROM SUPPLY WHEN AVAILABLE:
          WUC=AACF
     AFSC     W ELAP    WMA     WPROB     K ELAP    KMA    KPROB     N ELAP4   NMA4   NPROB4    N ELAP5    NMA5    NPROB5
     423X0    0.00      0       0.00      0.00      0      0.00      0.00      0      0.00      2.95       2       1.00

*****IF REMOVED ITEM ALWAYS BENCH CHECKED BEFORE REPLACEMENT:
          WUC=AACF
     AFSC     PROB KWA   KWA ELAP   PROB NOT KWA   COND PROB WF   ELAP WF   COND PROB N4   ELAP N4   COND PROB N5   ELAP N5
     423X0       0.00       0.00          1.00            0.00        0.00          0.00       0.00          1.00        2.95


WUC=AAC     AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 1   1.4 HR   14 C  ACTIONS    322.7 MMH      55.58 MMH/1000FH
WUC=AAC     AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 2   5.6 HR   26 C  ACTIONS
WUC=AAC     AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 3  10.5 HR    1 C  ACTIONS
WUC=AAC     AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 1   4.5 HR   22 WA ACTIONS    530.9 MMH      91.46 MMH/1000FH
WUC=AAC     AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 2   7.2 HR   27 WA ACTIONS
WUC=AAC     AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 3  14.3 HR    2 WA ACTIONS
WUC=AAC     AFSC=  423X0   NOM=  FM ELECTRICAL                CREW= 1   2.0 HR    4 N5 ACTIONS      7.8 MMH       1.34 MMH/1000FH

WUC=AAC     AFSC=  534X0   NOM=  FM STRUCTURAL REPAIR         CREW= 1   1.8 HR    1 WA ACTIONS      1.8 MMH        .31 MMH/1000FH
              FOR WUC=AAC     REMOVALS= 29   ADJUSTED COUNT= 28  Q FACTOR=1.036   TOTAL IN SHOP=  56.
              WUC=AAC     UNIT MSBF=  130.    G PROB= .00772   OPA=  1


**********IF REMOVED ITEM REPLACED FROM SUPPLY WHEN AVAILABLE:
          WUC=AAC
     AFSC     W ELAP    WMA     WPROB      K ELAP    KMA    KPROB     N ELAP4   NMA4   NPROB4    N ELAP5    NMA5    NPROB5
     423X0    6.28      51       .91 }     0.00      0      0.00      0.00      0      0.00      1.95       4        .07
     534X0    1.80      1        .02 }.93  0.00      0      0.00      0.00      0      0.00      0.00       0       0.00

**********IF REMOVED ITEM ALWAYS BENCH CHECKED BEFORE REPLACEMENT:
          WUC=AAC
     AFSC     PROB KWA   KWA ELAP   PROB NOT KWA   COND PROB WF   ELAP WF   COND PROB N4   ELAP N4   COND PROB N5   ELAP N5
     423X0       .91       6.28           .07            0.00        0.00          0.00       0.00          1.00        1.95
     534X0       .02       1.80          0.00            0.00        0.00          0.00       0.00          0.00        0.00


WUC=AADHG   AFSC=  421X3   NOM=  FM AGE                       CREW= 1   1.0 HR    1 N5 ACTIONS      1.0 MMH        .17 MMH/1000FH
              FOR WUC=AADHG   REMOVALS=  0   ADJUSTED COUNT=  0  Q FACTOR=0.000   TOTAL IN SHOP=   1.
              WUC=AADHG   UNIT MSBF=  7257.   G PROB= .00014   OPA=  1
```

Figure 20. **Off-equipment file for AM32-60.**

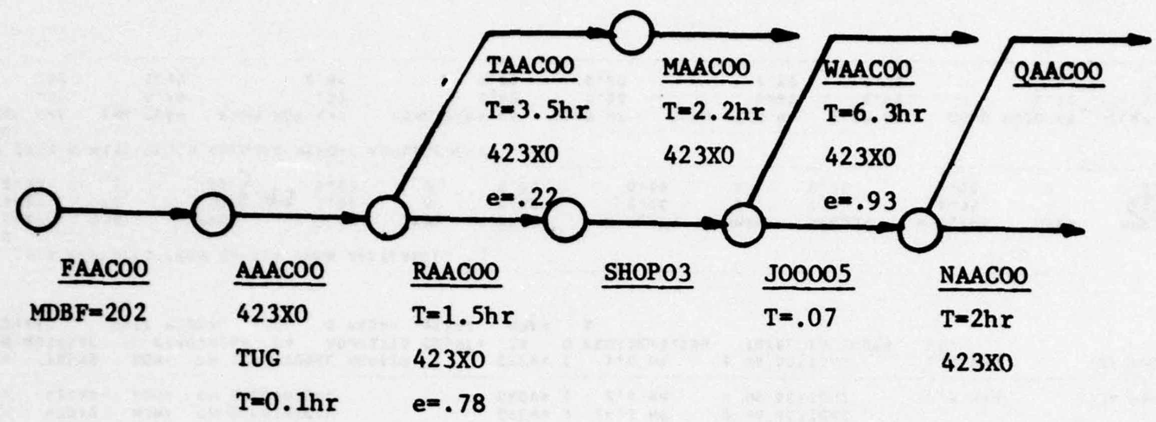

Figure 21. **Unscheduled maintenance AM32-60 generator general engine system task networks.**

The networks for the other components of the –60 and the NF-2 are analogous.

The first task depicted in Figure 21 is a failure clock with mean dispatches between failures (MDBF) indicated. The MDBF values were obtained from data obtained from the MDCAGE program and data from Figure 4. The rest of the network is developed in the same manner that unscheduled maintenance tasks are developed for airplanes; i.e., obtaining data and insight from the MDCAGE programs to develop an initial network and then checking and verifying these networks with maintenance specialists in the field.

Figures 22 and 23 are listings from LCOM Form 11s (extended). These illustrations represent all of the unscheduled maintenance tasks networks for the –60 and the NF-2, respectively. Normally, the unscheduled maintenance networks would not remove SE equipment from being operationally ready. The LCOM program assumes that they are associated with the aircraft, not the SE. Therefore, in order to get accurate statistics about the amount of time that the individual pieces of SE are down for maintenance, it is necessary to demand the appropriate piece of SE for every task in the unscheduled maintenance networks.

Results

Figures 24 and 25 are results obtained from an LCOM simulation of the A-7D SE work center. They address sensitivity studies performed for SE authorization levels, and personnel authorization levels. Both illustrations depict work centers that are performing over 99% of their missions. (Note the Operations Performance Summary.) Figure 24 represents a work center with an optimum level of manning. (Note the 60%-plus utilization of the 423X5s and the 603X0s in the Personnel Performance Summary. All other AFSCs are constrained by the necessity to have at least one of them assigned to the work center. However, Figure 24 also shows a low level of utilization of the SE. (Note the 60%-plus non-use of the –60 and the NF-2.) The apparent over-authorization of SE is necessary in order to assure that sufficient SE is operationally ready to perform 99%-plus of the missions of the SE work center.

Figure 25 represents an SE work center with an optimum authorization of SE. (Note the less than 34% non-use of the –60 and the NF-2.) However, the 423X5 and the 603X0 people are utilized less than 16% of the time. The excessive number of people are needed in order to assure that a large portion of the reduced amount of equipment is operationally ready a very large percentage of the time.

Thus, a tool has been developed and demonstrated whereby trade-offs between people and equipment can be investigated.

Figures 24 and 25 represent results obtained from the *first approach* recommended in Section I, Paragraph B. The primary advantages of the *first approach* over the *second approach* have been demonstrated; e.g., (a) the relative speed and simplicity with which initial answers may be obtained concerning manning and equipment authorizations for an SE work center as a function of operational demands on the center, and (b) the ease of conducting sensitivity analysis over the parameters just mentioned.

An LCOM simulation of the A-7D with the SE unscheduled maintenance networks incorporated per the *second approach* was performed. This approach gives more accurate results than does the *first*. It is recommended that the final answers be obtained via the *second approach* after the *first approach* is utilized to debug the SE unscheduled maintenance network, to obtain "ball park" answers, and to perform any sensitivity studies that may be needed.

IV. CONCLUSIONS

Various insights were obtained from this study effort. In the past, the whole concept of predicting manpower for SE has been obscured because the work centers have not been reviewed as a system in themselves. This study demonstrated that SE work centers can be treated thusly, and that they lend themselves quite readily to MMM modeling. The work centers respond to demands in a manner similar to the way aircraft maintenance responds to a flying schedule; e.g., SE dispatch activity drives the consumption of unscheduled maintenance, servicing, and pickup and delivery manhours in the same manner that aircraft sorties drives the consumption of unscheduled maintenance and servicing of aircraft.

It was also demonstrated that the interaction between the number of pieces of SE equipment on hand and the sortie rate of the weapon system and the manpower requirements can be accounted for. A new methodology has been developed which allows the analyst to investigate these interactions, and to attain a clearer understanding of the complexities that demands from various aircraft and equipment types place on the SE work center.

AF Form 864, *Daily Requirement and Dispatch Record*, is a key element in the analysis, and has been completely ignored in past SE work center study efforts. These records provide data as to when, how long, and by what aircraft or organization SE is used. It also provides a basis for computing failure rates for SE, which would be based upon mean demands on SE before maintenance actions. However, it should also be recognized that AF Form 864 may produce a very ill-defined dispatch activity if care is not taken. Such factors as pre-plants, sub-pools and multiple aircraft utilization of SE may come into play many times and they must be dealt with.

Differences between air bases, possibly reflecting differences in operational utilization and environment, can also be a factor influencing the dispatch and/or failure rates of SE. When selecting an air base from which to obtain completed AF Forms 864 upon which failures per demand are to be based, it would be wise to select a base that has operational and environmental conditions similar to those proposed at the work center being modeled. Further research is suggested to identify relevant environmental and operational factors, and establish procedures for taking the significant variables into account. The total answer will not be available until an intensive future effort is made to identify an improved measure for predicting SE failures which accounts for all significant factors.

REFERENCES

Hicks, V.B., & Tetmeyer, D.C. *Simulating maintenance manning for new weapon systems: Data base management programs.* AFHRL-TR-74-97(IV), AD-A011 989. Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory, December 1974.

Maher, F.A., & York, M.L. *Simulating maintenance manning for new weapon systems: Maintenance manpower management during weapon system development.* AFHRL-TR-74-97(I), AD-A011 986. Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory, December 1974.

Moody, W.D., Tetmeyer, D.C., & Nichols, S.R. *Simulating maintenance manning for new weapon systems: Manpower programs.* AFHRL-TR-74-97(V), AD-A011 990. Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory, December 1974.

Tetmeyer, D.C., & Moody, W.D. *Simulating maintenance manning for new weapon systems: Building and operating a simulation model.* AFHRL-TR-74-97(II), AD-A011 987. Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory, December 1974.

Tetmeyer, D.C., Nichols, S.R., & Deem, R.N. *Simulating maintenance manning for new weapon systems: Maintenance data analysis programs.* AFHRL-TR-74-97(III), AD-A025 342. Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory, May 1976.

Tetmeyer, D.C., Nichols, S.R., Hart, W.L., & Maher, F.A. *Simulating maintenance manning for new weapon systems: Maintenance manpower matrix program.* AFHRL-TR-74-97(VI), AD-A025 311. Wright-Patterson AFB, OH: Advanced Systems Division, Air Force Human Resources Laboratory, May 1976.

TO 00-20 2, *The maintenance data collection system.*

TO 0025-06-2-2, *Support equipment work unit code manual.*

TO 35C2-3-1-06, *FSC 6115 electrical generator sets, engine.*

TO 35-1, *Application of Air Force registration numbers.*

```
                 H              AAA00 CHASIS/BODY/ENCLOSURE/MOBILITY
  AAA00 FAAA00  AAA01 F     70 AAA00 21
  AAA01 AAAA00  AAA02 D        AAA00*21     1   C 1D60   1TUG   1423X5
  AAA02 MAAA00        E     33 AAA00 21    15 29L 1D60   1423X3
  AAA02 MAAA01        E     08 AAA00 21    24 29L 1D60   1534X0
  AAA02 RAAA00  AAA03 E     59 AAA00 21    20 29L 1D60   1423X3
  AAA03 SHOP   SAAA00 D        AAA00 21
 SAAA00 LAAA01        G 00336 AAA00 21
 SAAA00 LAAA02 IAAA00 G 00510 AAA00 21
 IAAA00 WAAA01        E     14 AAA00 21    20 29L 1D60   1523X0
 IAAA00 WAAA02        E     76 AAA00 21    25 29L 1D60   1534X0
 IAAA00 J00000 IAAA01 E     10 AAA00 23
 IAAA01 QAAA00        D        AAA00 23
 IAAA01 NAAA00        D        AAA00 21    10 29L 1421X8
                 H              AAB00 D60 ELECTRIC POWER GENERATOR
  AAB00 FAAB00  AAB01 F     77 AAB00 21
  AAB01 AAAB00  AAB02 D        AAB00*21     1   C 1TUG   1423X5 1D60
  AAB02 TAAB00  AAB03 E     19 AAB00 21    40 29L 1D60   1423X3
  AAB03 MAAB00        D        AAB00 21    13 29L 1D60   1423X5
  AAB02 RAAB00  AAB04 E     81 AAB00 21    22 29L 1D60   1423X5
  AAB04 SHOP2  SAAB00 D        AAB00 21
 SAAB00 LAAB01        G 00280 AAB00 21
 SAAB00 LAAB02 IAAB00 G 00772 AAB00 21
 IAAB00 WAAB01        E     59 AAB00 21    50 29L 1423X0 1D60
 IAAB00 WAAB02        E     04 AAB00 21    12 29L 1532X0 1D60
 IAAB00 J00001 IAAB01 E     37 AAB00 21
 IAAB01 NAAB00        D        AAB00 23    12 29L 1423X0
 IAAB01 QAAB00        D        AAB00 21
                 H              AAC00 D50 ENGINE SYSTEM-GENERAL
  AAC00 FAAC00  AAC01 F    202 AAC00 21
  AAC01 AAAC00  AAC02 D        AAC00*21     1   C 1TUG   1D60   1423X0
  AAC02 TAAC00  AAC03 E     22 AAC00 21    35 29L 1423X0 1D60
  AAC03 MAAC00        D        AAC00 21    22 29L 1423X0 1D60
  AAC02 RAAC00  AAC04 E     78 AAC00 21    15 29L 1423X0 1D60
  AAC04 SHOP03 SAAC00 D        AAC00 21
 SAAC00 J00C04 IAAC00 D        AAC00 21
 IAAC00 WAAC00        E     93 AAC00 21    63 29L 1423X0 1D60
 IAAC00 J00C05 IAAC01 E     87 AAC00 21
 IAAC01 NAAC00        D        AAC00 23    20 29L 1423X0
 IAAC01 QAAC00        D        AAC00 21
                 H              AAE00 D50 GAS TURBINE ENGINE
  AAE00 FAAE00  AAE01 F     85 AAE00 21
  AAE01 AAAE00  AAE02 D        AAE00*21     1   C 1423X5 1D60   1TUG
  AAE02 MAAE00        E     49 AAE00 21    29 29L 1423X5 1D60
  AAE02 RAAE00  AAE03 E     51 AAE00 21    43 29L 1423X5 1D60
  AAE03 SHOP04 SAAE00 D        AAE00 21
 SAAE00 LAAE01        G 00370 AAE00 21
 SAAE00 LAAE02 IAAE00 G 00220 AAE00 21
 IAAE00 WAAE01        E     56 AAE00 21    13 29L 1523X0 1D60
 IAAE00 WAAE00        E     04 AAE00 21    12 29L 1534X0 1D60
 IAAE00 J00035 IAAE01 E     40 AAE00 21
 IAAE01 NAAE00        D        AAE00 23    15 29L 1423X5 1D60
 IAAE01 QAAE00        D        AAE00 21
```

Figure 22. LCOM extended Form 11 listing for AM32-60.

```
                       H         AC2A0     NF-2 RUNNING GEAR
     AC2A0 FAC2A0  AC2A1 F   202 AC2A0 21
     AC2A1 AAC2A0  AC2A2 D       AC2A0*21     1   C 1TUG    1NF2    1423X5
     AC2A2 MAC2A0        E    57 AC2A0 21    12 29L 1NF2    1423X5
     AC2A2 RAC2A0        E    43 AC2A0 21    37 29L 1NF2    1423X5
                       H         AC2B0     NF-2 BODY AND BASE
     AC2B0 FAC2B0  AC2B1 F   275 AC2B0 21
     AC2B1 AAC2B0  AC2B2 D       AC2B0*21     1   C 1TUG    1NF2    1423X5
     AC2B2 MAC2B0        E    50 AC2B0 21    20 29L 1NF2    1423X5
     AC2B2 RAC2B0  AC2B3 E    50 AC2B0 21    15 29L 1NF2    1423X5
     AC2B3 SHOP10 SAC2B0 D       AC2B0 21
    SAC2B0 J00006 IAC2B0 E    13 AC2B0 21
    SAC2B0 WAC2B0        E    07 AC2B0 21    35 29L 1NF2    1423X5
    IAC2B0 NAC2B0        D       AC2B0 21    17 29L 1423X5
    IAC2B0 QAC2B0        D       AC2B0 23
                       H         AC2C0     NF-2 INSTUMENT PANEL
     AC2C0 FAC2C0  AC2C1 F   551 AC2C0 21
     AC2C1 AAC2C0  AC2C2 D       AC2C0*21     1   C 1NF2    1TUG    1423X5
     AC2C2 MAC2C0        E    27 AC2C0 21    10 29L 1NF2    1423X5
     AC2C2 RAC2C0        E    64 AC2C0 21    13 29L 1NF2    1423X5
     AC2C2 RAC2C1        E    09 AC2C0 21    25 29L 1NF2    1532X0
                       H         AC2E0     NF-2 ENGINE
     AC2E0 FAC2E0  AC2E1 F    88 AC2E0 21
     AC2E1 AAC2E0  AC2E2 D       AC2E0*21     1   C 1NF2    1TUG    1423X5
     AC2E2 RAC2E1  AC2E3 E    29 AC2E0 21    50 29L 1NF2    1531X0
     AC2E2 MAC2E0        E    67 AC2E0 21    40 29L 1NF2    1423X5
     AC2E2 MAC2E1        E    04 AC2E0 21    10 29L 1NF2    1531X0
     AC2E3 SHOP11 SAC2E0 D       AC2E0 21
    SAC2E0 LAC2E0        G 00150 AC2E0 21
    SAC2E0 LAC2E1 IAC2E1 G 00142 AC2E0 21
    IAC2E1 WAC2E0        E    09 AC2E0 21     5 29L 1NF2    1423X5
    IAC2E1 WAC2E1        E    55 AC2E0 21    13 29L 1NF2    1532X0
    IAC2E1 J00030 IAC2E2 E    35 AC2E0 21
    IAC2E2 NAC2E0        D       AC2E0 23    20 29L 1NF2    1423X5
    IAC2E2 QAC2E0        D       AC2E0 21
                       H         AC2F0     NF-2 GENERATOR
     AC2F0 FAC2F0  AC2F2 F   202 AC2F0 21
     AC2F2 AAC2F0  AC2F3 D       AC2F0*21     1   C 1NF2    1TUG    1423X5
     AC2F3 MAC2F0        E    63 AC2F0 21     8 29L 1NF2    1423X5
     AC2F3 RAC2F0  AC2F4 E    37 AC2F3 21    22 29L 1NF2    1423X5
     AC2F4 SHOP12 SAC2F0 D       AC2F0 21
    SAC2F0 MAC2F0        E    92 AC2F0 21    24 29L 1NF2    1423X5
    SAC2F0 WAC2F1        E    03 AC2F0 21    12 29L 1NF2    1532X0
    SAC2F0 JAC2F0 IAC2F0 E    05 AC2F0 21
    IAC2F0 NAC2F0        D       AC2F0 23    55 29L 1NF2    1423X5
    IAC2F0 QAC2F0        D       AC2F0 21
                       H         AC2G0     NF-2 CONTROL BOX
     AC2G0 FAC2G0  AC2G1 F   757 AC2G0 21
     AC2G1 AAC2G0  AC2G2 D       AC2G0 21     1   C 1NF2    1423X5 1TUG
     AC2G2 MAC2G0        E    63 AC2G0 21    07 29L 1NF2    1423X5
     AC2G2 RAC2G0        E    37 AC2G0 21    10 29L 1NF2    1423X5
```

Figure 23. LCOM extented Form 11 listing for NF-2.

RUN NUMBER A7DAGE PERFORMANCE SUMMARY PERIOD FROM 60.00 TO 120.00

	OPERATIONS	TOTAL	DSPD60	DSPNF2	PED60	PENF2	
1	NUMBER OF MISSIONS REQUESTED	4409.00	2400.00	1980.00	9.00	20.00	0.00
2	NUMBER ACCOMPLISHED	4399.00	2397.00	1973.00	9.00	20.00	0.00
3	PERCENT ACCOMPLISHED	99.77	99.87	99.65	100.00	100.00	0.00
4	NUMBER OF SORTIES REQUESTED	4409.00	2400.00	1980.00	9.00	20.00	0.00
5	NUMBER ACCOMPLISHED	4399.00	2397.00	1973.00	9.00	20.00	0.00
6	PERCENT ACCOMPLISHED	99.77	99.87	99.65	100.00	100.00	0.00

	AIRCRAFT	TOTAL	XD60	XNF2	
7	NUMBER OF AIRCRAFT AUTH. (EOP)	19998.00	9999.00	9999.00	0.00
8	NUMBER OF AIRCRAFT-DAYS AVAIL.	1199880.00	599940.00*9940		0.00
9	PCT SORTIES (INCL ALERT)	0.00	0.00	0.00	0.00
10	PCT UNSCHED MAINTENANCE	0.00	0.00	0.00	0.00
11	PCT SCHED MAINTENANCE	0.05	0.06	0.05	0.00
12	PCT NORS	0.00	0.00	0.00	0.00
13	PCT SERVICE + MSN. WAIT	0.01	0.01	0.01	0.00
14	PCT OPERATIONALLY READY	99.93	99.92	99.94	0.00
15	AVG. AIRCRAFT TURNAROUND TIME	4.07	4.26	3.84	0.00
16	AVG. NO. OF SORTIES/ A/C /DAY	0.00	0.00	0.00	0.00

	PERSONNEL	TOTAL	421X3	423X0	423X5	523X0	531X0	532X0	534X0	603X0	
17	MANHOURS AUTHORIZED (100)	17318.37	2879.99	2879.99	9.60	2879.99	2879.99	2879.99	2879.99	28.80	0.00
18	MANHOURS AVAILABLE (100)	17318.37	2879.99	2879.99	9.60	2879.99	2879.99	2879.99	2879.99	28.80	0.00
19	PERCENT UTILIZATION	0.16	0.00	0.07	66.79	0.00	0.01	0.00	0.01	64.16	0.00
20	MANHOURS USED (100)	27.54	0.03	1.93	6.41	0.07	0.27	0.03	0.32	18.48	0.00
21	PCT UNSCHED. MAINTENANCE	24.08	100.00	100.00	62.10	100.00	100.00	100.00	100.00	0.00	0.00
22	PCT SCHED. MAINTENANCE	75.92	0.00	0.00	37.90	0.00	0.00	0.00	0.00	100.00	0.00
23	NUMBER OF MEN DEMANDED	13630.00	3.00	66.00	421.00	4.00	6.00	2.00	14.00	13114.00	0.00
24	PCT AVAILABLE (PRIME)	57.81	100.00	100.00	58.67	100.00	100.00	100.00	100.00	57.47	0.00
25	PCT AVAILABLE (SUBST.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	PCT PROV. BY EXPEDITE	17.36	0.00	0.00	0.95	0.00	0.00	0.00	0.00	18.01	0.00
27	PCT PROV. BY PREEMPTION	0.69	0.00	0.00	1.66	0.00	0.00	0.00	0.00	0.66	0.00
28	PCT DEMANDS NOT SATIS.	24.15	0.00	0.00	38.72	0.00	0.00	0.00	0.00	23.85	0.00
29	OVERTIME MANHOURS USED (100)	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
30	MANHOURS PER FLYING HOUR	6.26	0.01	0.44	1.46	0.02	0.06	0.01	0.07	4.20	0.00
31	MOST TROUBLESOME PERS. ITEMS	0.00	3.01	3.02	3.03	4.01	4.02	4.03	5.01	5.02	5.03

Figure 24. **Results from A-7D SE work center simulation with optimum manning.**

RUN NUMBER A7DAGE PERFORMANCE SUMMARY PERIOD FROM 60.00 TO 120.00

	SHOP REPAIR	TOTAL	OTHERS	AAA00	AAB00	AAC00	AAE00	AC2B0	AC2E0	AC2F0	
32	NO. OF REPARABLE GENERATIONS	14.00	0.00	3.00	7.00	2.00	1.00	0.00	1.00	0.00	0.00
33	PCT BASE REPAIR	100.00	0.00	100.00	100.00	100.00	100.00	0.00	100.00	0.00	0.00
34	PCT DEPOT REPAIR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	AVERAGE BASE REPAIR CYCLE	27.75	0.00	30.04	30.06	0.30	0.14	0.00	0.00	0.00	0.30
36	PCT ACTIVE REPAIR	100.00	0.00	100.00	100.00	0.00	100.00	0.00	0.00	0.00	0.00
37	PCT WHITE SPACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
38	NO. OF ITEMS IN REPAIR (EOP)	7.00	0.00	2.00	2.00	2.00	0.00	0.00	1.00	0.00	0.00
39	NO. OF ITEMS BACKLOGGED (EOP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	SUPPLY	TOTAL	OTHERS	AAA00	AAB00	AAC00	AAE00	AC2B0	AC2E0	AC2F0	
40	TOT DOLLAR INVEST.(1000)(EOP)	1050.00	0.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	0.00
41	FILL RATE PERCENT	100.00	0.00	100.00	100.00	100.00	100.00	0.00	100.00	0.00	0.00
42	NUMBER OF BACKORDER-DAYS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	NUMBER OF UNITS DEMANDED	14.00	0.00	3.00	7.00	2.00	1.00	0.00	1.00	0.00	0.00
44	PCT OFF-THE-SHELF	100.00	0.00	100.00	100.00	100.00	100.00	0.00	100.00	0.00	0.00
45	PCT EXPEDITED REPAIR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
46	PCT PREEMPTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	PCT DEMANDS NOT SATIS.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	NUMBER OF CANNIBALIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	NO. ITEMS ON BACKORDER (EOP)	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00
50		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	MOST TROUBLESOME SUPPLY ITEMS	0.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	0.00	0.00

	EQUIPMENT	TOTAL	D60	NF4	TOW	TUG	
52	TOT DOLLAR INVEST.(1000)(EOP)	4640.00	360.00	280.00	2000.00	2000.00	0.00
53	EQUIPMENT HOURS AUTH. (100)	3340.80	259.20	201.60	1440.00	1440.00	0.00
54	EQUIPMENT HOURS AVAIL. (100)	3340.80	259.20	201.60	1440.00	1440.00	0.00
55	PCT USED - UNSCHED MAINT	0.20	1.85	0.85	0.00	0.01	0.00
56	PCT USED - SCHED MAINT	5.11	32.89	33.25	1.28	0.00	0.00
57	PCT UNUSED	94.69	65.25	65.91	98.72	99.98	0.00
58	NUMBER OF BACKORDER-DAYS	0.36	0.15	0.21	0.00	0.00	0.30
59	NUMBER OF UNITS DEMANDED	31338.00	9916.00	8071.00	13114.00	237.00	0.00
60	PCT AVAILABLE	99.99	99.99	99.99	100.00	100.00	0.00
61	PCT PROV. BY EXPEDITE	0.00	0.01	0.00	0.00	0.00	0.00
62	PCT PROV. BY PREEMPTION	0.00	0.00	0.00	0.00	0.00	0.00
63	PCT DEMANDS NOT SATIS.	0.00	0.00	0.01	0.00	0.00	0.00
64	EQUIP. HOURS BACKLOG(100)(EOP)	0.03	0.03	0.00	0.00	0.00	0.00
65	MOST TROUBLESOME EQUIP. ITEMS	0.00	11.00	12.00	13.00	14.00	0.00

Figure 24. (*Continued*)

RUN NUMBER A7DAGE — P E R F O R M A N C E   S U M M A R Y — PERIOD FROM 61.[illegible] TO 120.0[illegible]

	O P E R A T I O N S	TOTAL	DSPD60	DSPNF2	PED60	PENF2	
1	NUMBER OF MISSIONS REQUESTED	4409.00	2400.00	1980.00	9.00	20.00	0.00
2	NUMBER ACCOMPLISHED	4335.00	2338.00	1968.00	9.00	20.00	0.00
3	PERCENT ACCOMPLISHED	98.32	97.42	99.39	100.00	100.00	0.00
4	NUMBER OF SORTIES REQUESTED	4409.00	2400.00	1980.00	9.00	20.00	0.00
5	NUMBER ACCOMPLISHED	4335.00	2338.00	1968.00	9.00	20.00	0.00
6	PERCENT ACCOMPLISHED	98.32	97.42	99.39	100.00	100.00	0.00

	A I R C R A F T	TOTAL	XD60	XNF2	
7	NUMBER OF AIRCRAFT AUTH. (EOP)	19998.00	9999.00	9999.00	0.00
8	NUMBER OF AIRCRAFT-DAYS AVAIL.	119988.00	59994.00*994[illegible]		0.00
9	PCT SORTIES (INCL ALERT)	0.00	0.00	0.00	0.00
10	PCT UNSCHED MAINTENANCE	0.00	0.00	0.00	0.00
11	PCT SCHED MAINTENANCE	0.05	0.06	0.05	0.00
12	PCT NORS	0.00	0.00	0.00	0.00
13	PCT SERVICE + MSN. WAIT	0.00	0.00	0.00	0.00
14	PCT OPERATIONALLY READY	99.94	99.93	99.95	0.00
15	AVG. AIRCRAFT TURNAROUND TIME	3.67	3.76	3.56	0.00
16	AVG. NO. OF SORTIES/ A/C /DAY	[illegible]	[illegible]	[illegible]	0.00

	P E R S O N N E L	TOTAL	421X3	423X0	423X5	523X0	531X0	532X0	534X0	603X0	
17	MANHOURS AUTHORIZED (100)	17452.77	2879.99	2879.99	57.60	2879.99	2879.99	2879.99	2879.99	115.20	0.00
18	MANHOURS AVAILABLE (100)	17452.77	2879.99	2879.99	57.60	2879.99	2879.99	2879.99	2879.99	115.20	0.00
19	PERCENT UTILIZATION	0.15	0.00	0.06	11.65	0.00	0.01	0.00	0.01	15.33	0.00
20	MANHOURS USED (100)	26.67	0.01	1.61	6.72	0.09	0.32	0.02	0.22	17.53	0.00
21	PCT UNSCHED. MAINTENANCE	24.66	100.00	100.00	64.02	100.00	100.00	100.00	100.00	0.00	0.00
22	PCT SCHED. MAINTENANCE	75.34	0.00	0.00	35.98	0.00	0.00	0.00	0.00	100.00	0.00
23	NUMBER OF MEN DEMANDED	13410.00	1.00	60.00	406.00	6.00	8.00	2.00	9.00	12918.00	0.00
24	PCT AVAILABLE (PRIME)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	0.00
25	PCT AVAILABLE (SUBST.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	PCT PROV. BY EXPEDITE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	PCT PROV. BY PREEMPTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	PCT DEMANDS NOT SATIS.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	OVERTIME MANHOURS USED (100)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	MANHOURS PER FLYING HOUR	6.15	0.00	0.37	1.55	0.02	0.07	0.01	0.35	4.18	0.00
31	MOST TROUBLESOME PERS. ITEMS	0.00	3.01	3.02	3.03	4.01	4.02	4.03	5.01	5.02	5.03

Figure 25. **Results from A-7D SE work center simulation with optimum SE assigned.**

RUN NUMBER A7DAGE P E R F O R M A N C E S U M M A R Y PERIOD FROM 60.00 TO 120.00

	S H O P R E P A I R	TOTAL	OTHERS	AAA00	AAB00	AAC00	AAE00	AC2B0	AC2E0	AC2F0	
32	NO. OF REPARABLE GENERATIONS	17.00	0.00	1.00	7.00	0.00	6.00	1.00	2.00	0.00	0.00
33	PCT BASE REPAIR	100.00	0.00	100.00	100.00	0.00	100.00	100.00	100.00	0.00	0.00
34	PCT DEPOT REPAIR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	AVERAGE BASE REPAIR CYCLE	28.07	0.00	34.05	35.[illegible]5	0.00	[illegible]	3[illegible].[illegible]7	3[illegible].[illegible]9	0.00	0.00
36	PCT ACTIVE REPAIR	100.00	0.00	100.00	100.00	0.00	100.00	100.00	100.00	0.00	0.00
37	PCT WHITE SPACE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
38	NO. OF ITEMS IN REPAIR (EOP)	3.00	0.00	1.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
39	NO. OF ITEMS BACKLOGGED (EOP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	S U P P L Y	TOTAL	OTHERS	AAA00	AAB00	AAC00	AAE00	AC2B0	AC2E0	AC2F0	
40	TOT DOLLAR INVEST.(1000)(EOP)	1050.00	0.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	0.00
41	FILL RATE PERCENT	100.00	0.00	100.00	100.00	0.00	100.00	100.00	100.00	0.00	0.00
42	NUMBER OF BACKORDER-DAYS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
43	NUMBER OF UNITS DEMANDED	17.00	0.00	1.00	7.00	0.00	6.00	1.00	2.00	0.00	0.00
44	PCT OFF-THE-SHELF	100.00	0.00	100.00	100.00	0.00	100.00	100.00	100.00	0.00	0.00
45	PCT EXPEDITED REPAIR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
46	PCT PREEMPTION	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	PCT DEMANDS NOT SATIS.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	NUMBER OF CANNIBALIZATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	NO. ITEMS ON BACKORDER (EOP)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	MOST TROUBLESOME SUPPLY ITEMS	0.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	0.00	0.00

	E Q U I P M E N T	TOTAL	D6L	NF4	TOW	TUG	
52	TOT DOLLAR INVEST.(1000)(EOP)	432[illegible]	180.00	140.00	2000.00	2000.00	0.00
53	EQUIPMENT HOURS AUTH. (100)	311[illegible].40	129.60	1[illegible]0.8[illegible]	1440.00	1440.00	0.00
54	EQUIPMENT HOURS AVAIL. (100)	3117.40	129.60	100.80	1440.00	1440.00	0.00
55	PCT USED - UNSCHED MAINT	0.21	3.44	1.98	0.00	0.01	0.00
56	PCT USED - SCHED MAINT	5.28	62.95	64.30	1.23	0.00	0.00
57	PCT UNUSED	94.51	33.61	33.72	98.77	99.96	0.00
58	NUMBER OF BACKORDER-DAYS	54.36	25.53	28.83	0.00	0.00	0.00
59	NUMBER OF UNITS DEMANDED	3[illegible]	9639.00	8068.00	12918.00	23[illegible]	0.00
60	PCT AVAILABLE	9[illegible].21	83.61	82.14	100.00	100.00	0.00
61	PCT PROV. BY EXPEDITE	4.12	7.53	6.77	0.00	0.00	0.00
62	PCT PROV. BY PREEMPTION	0.85	0.73	2.19	0.00	0.00	0.00
63	PCT DEMANDS NOT SATIS.	4.87	8.13	8.92	0.00	0.00	0.00
64	EQUIP. HOURS BACKLOG(100)(EOP)	0.03	0.03	0.00	0.00	0.00	0.00
65	MOST TROUBLESOME EQUIP. ITEMS	0.00	11.00	12.00	13.00	14.00	0.00

Figure 25. (*Continued*)

APPENDIX A: TRNAGE DISCUSSION AND LISTING

TRNAGE is a modification of TRN9T07 (AFHRL-TR-74-97(III)) which extracts SE data only from the ABD64-A tapes. It also pulls off specific equipment classes as restrained by card input. Equipment class codes AA-AZ have dummy equipment class codes assigned based on their NIIN's.

```
      PROGRAM TRN9TO7(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7,TAPE8)
      DIMENSION A(200),B(507)
      INTEGER ACFT,      OUTPUTR,RECORD,EOF,PARITY,TYPE,REJECTS,A,B
      REJECTS=0
      READ (5,1) TYPE
    1 FORMAT(R2)
      NTYPE=0
      OUTPUTR=0
      RECORD=0
      PARITY=0
      EOF=0
      K1=1
    2 BUFFER IN (8,0) (A(1),A(200))
      RECORD=RECORD+1
      IF (UNIT(8)) 3,4,5
    4 EOF=EOF+1
      WRITE (6,6) EOF,RECORD
    6 FORMAT (12H0END OF FILE,I10,12H   IN RECORD,I10)
      IF (EOF-2) 2,41,40
   41 BUFFER IN (8,0) (A(1),A(200))
      IF (UNIT(8)) 42,40,40
   42 LEN=LENGTH(8)
      IF (LEN.NE.0) GO TO 50
   17 DECODE (80,49,A(1)) IENDTAP,NUMDATA
   49 FORMAT(T40,R1,T46,R7)
      PRINT 48,IENDTAP,NUMDATA,RECORD
   48 FORMAT(* END OF TAPE INDICATOR WAS *,R1,*  NUMBER OF RECORDS IN D
     1ATA FILE GIVEN AS *,R7,*  RECORD COUNT = *,I10)
      IF (IENDTAP.EQ.1R0) GO TO 2
      IF (IENDTAP.NE.1R1) GO TO 40
      CALL REMARK(65HOPERATOR, PLEASE PUT UP THE NEXT OF THE MULTI-REELS
     1 FOR LF TAPE8.)
      REWIND 8
      PAUSE 55727
      EOF=0
      RECORD=0
      GO TO 2
C  16 WORDS PER LINE OF AIRCRAFT DATA INPUT
C  ONLY 13 WORDS KEPT FOR OUTPUT
C   39 LINES * 13 WORDS = 507 WORDS PER OUTPUT RECORD
   40 LAST=507
      K2=MOD(NTYPE*13,507)
      IF (K2.EQ.0) GO TO 21
      LAST=K2
      OUTPUTR=OUTPUTR+1
      BUFFER OUT (7,1) (B(1),B(K2))
      IF (UNIT(7)) 21,30,30
   21 WRITE (6,19) OUTPUTR,NTYPE,TYPE
   19 FORMAT(10H0THERE ARE,I7,28H   OUTPUT RECORDS CONTAINING,I10,14H
     1LINES OF    ,A10,16H   AIRCRAFT DATA)
      WRITE (6,22) LAST
   22 FORMAT(25H0THE LAST RECORD CONTAINS,I5,8H   WORDS)
   24 WRITE (6,23) REJECTS,NTYPE,TYPE,OUTPUTR,RECORD,PARITY,EOF
   23 FORMAT (8H0REJECTS,I10,8H   NTYPE,I10,7H   TYPE,3XR2, 9H  OUTPUTR,
     1I10,9H   RECORD,I10,9H   PARITY,I10,6H   EOF,I10)
   30 ENDFILE 7
      STOP
```

```
      5    PARITY=PARITY+1                                                  TRNAGE    59
           WRITE (6,7) PARITY,RECORD                                        TRNAGE    60
      7    FORMAT (13H0PARITY ERROR,I10,12H   IN RECORD,I10)                TRNAGE    61
           IF (PARITY.LE.15) GO TO 2                                        TRNAGE    62
           GO TO 24                                                         TRNAGE    63
      3    LEN=LENGTH(8)                                                    TRNAGE    64
           IF (RECORD-1) 8,16,8                                             TRNAGE    65
      C  WRITES OUT HEADER RECORD AND DROPS IT                              TRNAGE    66
     16    WRITE (6,9) RECORD,LEN,(A(I),I=1,LEN)                            TRNAGE    67
      9    FORMAT (7H0RECORD,I10,9H   LENGTH,I10/(1X,13A10))                TRNAGE    68
           GO TO 2                                                          TRNAGE    69
      8    IF (LEN.EQ.160) GO TO 13                                         TRNAGE    70
           WRITF (6,14) RECORD,LEN                                          TRNAGE    71
     14    FORMAT (7H0RECORD,I10,9H   LENGTH,I10)                           TRNAGE    72
           WRITE (6,23) REJECTS,NTYPE,TYPE,OUTPUTR,RECORD,PARITY,EOF        TRNAGE    73
     13    IF (LEN.EQ.0) GO TO 17                                           TRNAGE    74
           IF (MOD(LEN,16).NE.0) GO TO 50                                   TRNAGE    75
           LEN=LEN/16                                                       TRNAGE    76
           J=-15                                                            TRNAGE    77
           DO 10 I=1,LEN                                                    TRNAGE    78
           K=K1                                                             TRNAGE    79
           J=J+16                                                           TRNAGE    80
           I2=K                                                             TRNAGE    81
           I3=J                                                             TRNAGE    82
      C  ONLY WANT TO KEEP THE FIRST 130 CHARACTERS OUT OF THE 160 CHARACTER I TRNAGE  83
      C   ATTACH,CC6600,CC6600,ID=X656321,MR=1.     PLACE IN JOB STREAM IF  TRNAGE    84
      C   LIBRARY,CC6600.                           CALL STRING IS USED.    TRNAGE    85
      C    CALL STRING(130,A(J), 1,B(K),1)          THE FOLLOWING 5 CARDS REPLAC TRNAGE 86
      C                                             CALL STRING.  USE STRING FOR TRNAGE 87
      C                                             DEBLOCKING RECORDS WHEN NEED TRNAGE 88
           DO 99 I1=1,13                                                    TRNAGE    89
           B(I2)=A(I3)                                                      TRNAGE    90
           I3=I3+1                                                          TRNAGE    91
           I2=I2+1                                                          TRNAGE    92
     99    CONTINUE                                                         TRNAGE    93
           I4=K+1                                                           TRNAGE    94
           DECODE (10,53,B(I4)) LPRE                                        TRNAGE    95
     53    FORMAT(3X,R1,6X)                                                 TRNAGE    96
           IF(LPRE.NE.1RG) GO TO 52                                         TRNAGE    97
           M=I4+11                                                          TRNAGE    98
           DECODE (10,51,B(M)) LFORM,ACFT                                   TRNAGE    99
     51    FORMAT(2X,R1,R2,5X)                                              TRNAGE   100
           IF(ACFT.EQ.TYPE) GO TO 52                                        TRNAGE   101
           IF ((LFORM.EQ.1R1).O.(LFORM.EQ.1R3)) GO TO 25                    TRNAGE   102
           IF ((LFORM.EQ.1R4).O.(LFORM.EQ.1R6).O.(LFORM.EQ.1R7)) GO TO 25   TRNAGE   103
      C  REJECTED RECORDS                                                   TRNAGE   104
     52    REJECTS=REJECTS+1                                                TRNAGE   105
           IF(REJECTS.GT.100) GO TO 10                                      TRNAGE   106
           K2=K+12                                                          TRNAGE   107
           WRITE(6,12) (B(J1),J1=K,K2)                                      TRNAGE   108
     12    FORMAT (1H0,13A10)                                               TRNAGE   109
           GO TO 10                                                         TRNAGE   110
      C   GOOD RECORDS                                                      TRNAGE   111
     25    NTYPE=NTYPE+1                                                    TRNAGE   112
           K1=K1+13                                                         TRNAGE   113
           IF (MOD(NTYPE,39).NE.0) GO TO 10                                 TRNAGE   114
           OUTPUTR=OUTPUTR+1                                                TRNAGE   115
           BUFFER OUT (7,1) (B(1),B(507))                                   TRNAGE   116
           IF (UNIT(7)) 32,30,30                                            TRNAGE   117
       32  K1=1                                                             TRNAGE   118
     10    CONTINUE                                                         TRNAGE   119
           GO TO 2                                                          TRNAGE   120
       50  ENDFILE 7                                                        TRNAGE   121
           STOP 7777                                                        TRNAGE   122
           END                                                              TRNAGE   123
```

```
      PROGRAM AGEPREP(INPUT,OUTPUT,TAPE27,TAPE8,TAPE20,TAPE21=INPUT)      AGEP
      INTEGER B(507),EQPCLS1(25),EQPCLS2(25)                              AGEP
      DATA EQPCLS1,EQPCLS2/25*0,25*0/                                     AGEP
      DO 5 I=1,25                                                         AGEP
      READ (21,1) EQPCLS1(I),EQPCLS2(I)                                   AGEP
1     FORMAT(2R1)                                                         AGEP
      IF (EOF(21)).9,2                                                    AGEP
2     PRINT 3,I,EQPCLS1(I),EQPCLS2(I)                                     AGEP
3     FORMAT(10H          ,I2,4X,2R1)                                     AGEP
5     CONTINUE                                                            AGEP
      NUMEQP=25                                                           AGEP
      GO TO 30                                                            AGEP
9     NUMEQP=I-1                                                          AGEP
30    BUFFER IN (27,1) (B(1),B(507))                                      AGEP
      IF (UNIT(27)) 10,50,50                                              AGEP
10    II=1                                                                AGEP
      GO TO 20                                                            AGEP
25    II=II+13                                                            AGEP
      IF (II.GT.597) GO TO 30                                             AGEP
20    DECODE (130,10991,B(II)) JCN,LWC,LPRE,LTAIL,LT,LWUC,LATC,LDISC,MAL AGEP
     1,MA,LSTRT,LDAY,LSTOP,LCREW,ITEM,ITM2,IFIIN,METI,IEND,MTH,LOTCLAS,  AGEP
     2IDPCD,LSUF1,LSUF2                                                   AGEP
10991 FORMAT(R7,R5,T14,R1,R4,T51,R1,T53,A5,2R1,R3,I2                      AGEP
     1,R4,I3,R4,R1,T87,A10,A1,R3,R6,T117,R1,I4,4R1)                       AGEP
C  LSUF1=0 THROUGH E                                                      AGEP
      IF (LSUF1-53) 60,95,90                                              AGEP
C  LSUF1=A GETS UNIQUE EQP. CLASS CODE ASSIGNED LSUF1 AND LSUF2 BASED ON AGEP
60    IF (LSUF1-18) 25,65,95                                              AGEP
C  LSUF1=Y                                                                AGEP
90    IF (LSUF1-318) 25,95                                                AGEP
C CHECK FOR ACCEPTABLE EQUIPMENT CLASS CODES                              AGEP
95    DO 99 I=1,NUMEQP                                                    AGEP
      IF (LSUF1-EQPCLS1(I)) 25,96,99                                      AGEP
96    IF (LSUF2-EQPCLS2(I)) 25,40,99                                      AGEP
99    CONTINUE                                                            AGEP
      GO TO 25                                                            AGEP
C  CHECK FOR ACCEPTABLE FIINS FOR EQUIPMENT CLASS CODES OF AA-AZ.         AGEP
65    REWIND 20                                                           AGEP
66    READ (20,67) MFIIN,MSUF1,MSUF2                                      AGEP
67    FORMAT(R3,2R1)                                                      AGEP
      IF (EOF(20)) 25,70                                                  AGEP
70    IF (IFIIN-MFIIN) 25,75,66                                           AGEP
75    LSUF1=MSUF1                                                         AGEP
      LSUF2=MSUF2                                                         AGEP
40    WRITE (8,10992) JCN,LWC,LPRE,LTAIL,LT,LWUC,LATC,LDISC,MAL,MA,       AGEP
     1LSTRT,LDAY,LSTOP,LCREW,ITEM,ITM2,IFIIN,METI,IEND,MTH,LOTCLAS,       AGEP
     2IDPCD,LSUF1,LSUF2                                                   AGEP
10992 FORMAT(R7,R5,R1,R4,R1,A5,2R1,R3,I2,R4,I3,R4,R1,A10,A1,R3,R6,R1,     AGEP
     1I4,4R1)                                                             AGEP
      GO TO 25                                                            AGEP
   50 CONTINUE                                                            AGEP
      END                                                                 AGEP
```

APPENDIX B: GETAGE DISCUSSION AND LISTING

GETAGE is a version of GETDATA (AFHRL-TR-74-97(III)) for SE equipment. It uses a formatted READ on one record at a time rather than a buffer in of 39 records. It treats only one type of equipment class code data at a time; i.e., when a new code is encountered, it treats that like an end-of-file. Records which are dropped are printed out and labelled as "unacceptable record." Work Unit Codes (WUC) with the left-most character of a letter or of zero are kept. The AGE SERVICE file replaces the aircraft SCHEDULED file, NTYPE=3. It is split off from the other files by having a zero as the left-most character in the WUC. Since it has no action taken codes, a maintenance type code (variable name LT) of A is assigned a 1, D=2, P=3, and S=4. On=equipment (NTYPE=1) and off-equipment (NTYPE-0-6) files must have maintenance type codes of P, B, or S to be acceptable. In GETDATA for on-equipment data, the how malfunctioned code of 799 is only kept when it is accompanied by an action taken code of X. In GETAGE all 799 codes are kept. GETDATA for on-equipment data drops how malfunctioned codes of 800 and 805 for action taken codes of P and R. GETAGE keeps P's and R's with 800's and 805's. MA≥5 have records printed out for user to check but are not dropped. *NO ENGINE*, NTYPE=4 is split out for SE equipment.

```
PROGRAM GETAGE      74/74   OPT=1                        FTN 4.5+414        01/04/77  15.47.05        PAGE    1

      PROGRAM GETAGE (OUTPUT,TAPE7=2049,TAPE1,TAPE6=2049,INPUT,         GETAGE      2
     1TAPE4=INPUT,TAPE8,TAPE40)                                         11NOV6      1
      DIMENSION IWCID(90),IAFSC(90),NOM(3),MTRXDIS(5),PERCENT(5)       GETAGE      4
      INTEGER ATCS(17),ATCC(18),WUCLVL    ,SCOUNT,        WUCKEEP(10),CHEK GETAGE   5
     1WUC                                                               GETAGE      6
      DATA NTAPE/7/,MTRXDIS/5*0/,                                       GETAGE      7
     1ATCS/1RP,1RR,1RM,1RY,1RX,1RF,1RG,1RL,1RV,1RZ,1RJ,1RK,1RB,1RC,1RA, GETAGE      8
     21RM,1RN/,ATCC/5,4,2*3,2,7*1,2,3,4,2*5,6/                          GETAGE      9
     3,WUCKEEP/3R000,9*0/                                               GETAGE     10
      DATA       IHTAIL,IHPRE,IHLT,IHSUF,        IHWUC,IHATC,IHMAL,IHMA, GETAGE    11
     1IHDISC,IHMMH,IHWC,IHJCN,    IHDAY,        IHCREW/14*0/            GETAGE     12
      DATA IHSTOP,IHSTRT,IHIDRCD,IHOTCLS/4*0/                           GETAGE     13
      IFOPCLS=0                                                         GETAGE     14
      L1 = 1                                                            GETAGE     15
      MMM = 0                                                           GETAGE     16
      IA=0                                                              GETAGE     17
      IC=0                                                              GETAGE     18
      IE=0                                                              GETAGE     19
      IG=0                                                              GETAGE     20
      ICNT=59                                                           GETAGE     21
C  COLUMN 6 IS VARIABLE  IADJUST  WHICH MUST BE 6 IF THE ADJUST PROGRAM GETAGE     22
C  USED BEFORE COMBINE PROGRAM.  IF = 6, THEN  NTYPE = 6 FOR OFF-EQUIP. GETAGE     23
C  THAN 6 NTYPE =2 AS USUAL.  ALSO, REMEMBER TO CHANGE THE SORTMRG OUTPU GETAGE    24
C  CARD TO TAPE4  INSTEAD OF TAPE2  IF ADJUST IS USED.                  GETAGE     25
      READ (4,19992) MDS,M,WUCLVL,INDXDIS,IADJUST,ISCRTIE,ISORTCK       GETAGE     26
19992 FORMAT(R2,4I1,T20,I5,T20,R5)                                      GETAGE     27
      IF ((WUCLVL.NE.3).A.(WUCLVL.NE.4)) WUCLVL=5                       GETAGE     28
      INDXDIS=1                                                         GETAGE     29
      IF ((INDXDIS.LE.0).O.(INDXDIS.GT.5)) INDXDIS=5                    GETAGE     30
      PRINT 19996,MDS,M,WUCLVL,INDXDIS,IADJUST                          GETAGE     31
19996 FORMAT(* MDS = *,R2,*   # TAPES = *,I1,*   WUCLVL = *,I1,*   WHEN GETAGE     32
     1DISCOVERED CHOICE = *,I1,*   AND IADJUST CHOICE =*,I2)            GETAGE     33
      M=8-M                                                             GETAGE     34
      DO 19993 I1=1,91                                                  GETAGE     35
      READ(40,19991) IWCID(I1),NOM,IAFSC(I1)                            11NOV6      2
      IF(EOF(40))19994,19993                                            11NOV6      3
19993 PRINT 19995,I1,IWCID(I1),NOM,IAFSC(I1)                            GETAGE     38
19995 FORMAT(10X,I2,5XR5,5X,2A10,A6,5XR5)                               GETAGE     39
19991 FORMAT(R5,2A10,A6,R5)                                             GETAGE     40
19994 IWCS=I1-1                                                         GETAGE     41
      DO 99995 I1=1,11                                                  GETAGE     42
      READ (4,99991) WUCKEEP(I1)                                        GETAGE     43
99991 FORMAT(R3)                                                        GETAGE     44
      IF (EOF(4)) 99996,99992                                           GETAGE     45
99992 IF (WUCKEEP(I1).EQ.3R000) GO TO 99994                             GETAGE     46
      PRINT 99993,I1,WUCKEEP(I1)                                        GETAGE     47
99993 FORMAT(* PROCESS WUC(*,I2,*) = *,R3,*--.*)                        GETAGE     48
      GO TO 99995                                                       GETAGE     49
99994 PRINT 99999                                                       GETAGE     50
99999 FORMAT(* PROCESS ALL GOOD WUC RECORDS.*)                          GETAGE     51
      WUCKEEP(1)=3R000                                                  GETAGE     52
      GO TO 99996                                                       GETAGE     53
99995 CONTINUE                                                          GETAGE     54
99996 CONTINUE                                                          GETAGE     55
10000 READ  (7,10991) JCN,LWC,LPRE,LTAIL,LT,LWUC,LATC,LDISC,MAL,MA,     GETAGE     56
     1LSTRT,LDAY,LSTOP,LCREW,ITEM,ITM2,IFIIN,METI,IEND,MMH,LOTCLAS,     GETAGE     57
     2IDRCD,LSUF                                                        GETAGE     58
```

```
10991 FORMAT(R7,R5,R1,R4,R1,A5,2R1,R3,I2,R4,I3,R4,R1,A10,A1,R3,R6,R1,
     1I4,R1,R1,R2)
      IF (EOF(7)) 10900,10180
10180 IF((IORGO.NE.1R1).A.(IORGO.NE.1R3)) GO TO 10380
      IF (IEQPCLS.EQ.0) IEQPCLS=LSUF
      IF (IEQPCLS.NE.LSUF) GO TO 10900
      IF (LSUF.NE.MDS) PRINT 10181,LSUF,MDS
10181 FORMAT(* WARNING! THIS RUN IS FOR EQUIPMENT CLASS CODE *, R2,
     1* RATHER THAN FOR *,R2)
      IA=IA+1
      IF (LT.EQ.1RZ) GO TO 10380
      DECODE(10,55,LWUC) LO
   55 FORMAT(R1,9X)
      IF ((LO.LT.1RA).O.(LO.GT.1R0)) GO TO 10380
      IC=IC+1
      IF (WUCKEEP(1).EQ.3R000) GO TO 90115
      DECODE (5,90111,LWUC) CHEKWUC
90111 FORMAT(R3,2X)
      DO 90112 I1=1,10
      IF (WUCKEEP(I1).EQ.CHEKWUC) GO TO 90115
      IF (WUCKEEP(I1).EQ.3R   ) GO TO 10000
90112 CONTINUE
      GO TO 10000
90115 SCOUNT=0
      IE=IE+1
      LSTDAY=LDAY
      IF (LSTOP.LE.LSTRT) LSTDAY=LSTDAY-1
      I = LWC.A.77777700008
      DO 10225 I1=1,IWCS
      IF (I.EQ.(IWCID(I1).A.77777700008)) GO TO 10250
10225 CONTINUE
      GO TO 10380
10250 IF ((IWCID(I1).A.7700B).EQ.3000B) GO TO 10350
      I=LWC.A.7700B
      IF (I.EQ.(IWCID(I1).A.7700B)) GO TO 10300
10275 I1=I1+1
      IG=IG+1
      IF (I1.GT.IWCS) GO TO 10380
      IF ((LWC.A.77777777000B).NE.(IWCID(I1).A.77777777000B)) GO TO 10275
10300 IF ((IWCID(I1).A.1R1).EQ.1RX) GO TO 10350
      I=LWC.A.1R1
      IF (I.EQ.(IWCID(I1).A.1R1)) GO TO 10350
10325 I1=I1+1
      IF (I1.GT.IWCS) GO TO 10380
      IF (LWC.NE.IWCID(I1)) GO TO 10325
10350 LWC=IAFSC(I1)
      IF ((LDTCLAS.EQ.1RD).O.(MAL.EQ.3R796).O.(MAL.EQ.3R812)) GO TO
     110380
      IF (LO.EQ.1R0) GO TO 10700
      IF ((LT.EQ.1RP).O.(LT.EQ.1R9).O.(LT.EQ.1RS)) GO TO 10440
10380 IF (ICNT.NE.59) GO TO 40
      PRINT 100
  100 FORMAT(1H1)
      PRINT 200
  200 FORMAT(3X,3HJCN,5X,3HLWC,2X,4HLPRE,1X,5HLTAIL,2X,2HLT
     1,2X,4HLWUC,2X,4HLATC,1X,5HLDISC,1X,3HMAL,2X,2HMA,1X
     2,5HLSTRT,1X,4HLDAY,1X,5HLSTOP,1X,5HLCREW,1X,3HMMM,2X,
```

```
              37HEOTCLAS,1X,5HIORCO,1X,4HLSUF)
              PRINT 300
      300     FORMAT(1X,3H---,5X,3H---,2X,4H----,1X,5H-----,2X,2H--
             1,2X,4H----,2X,4H----,1X,5H-----,1X,3H---,2X,2H--,1X
             2,5H-----,1X,4H----,1X,5H-----,1X,5H-----,1X,3H---,2X
             3,7H-------,1X,5H-----,1X,4H----)
              ICNT=0
       40     I=10HUNACCEPTAB
              J=10HLE RECORD
              PRINT 45,JCN,LWC,LPRE,LTAIL,LT,LWUC,LATC,LDISC,MAL
             1,MA,LSTRT,LDAY,LSTOP,LCREW,MMH,LOTCLAS,IORCO,LSUF,I,J
       45     FORMAT(1X,R7,2X,R5,3X,R1,3X,R4,3X,R1,2X,A5,3X,R1
             1,4X,R1,3X,R3,2X,I2,2X,R4,2X,I3,2X,R4,3X,R1,3X,I4,4X,R1,
             26X,R1,4X,R2,2X,2A10)
              ICNT=ICNT+1
              GO TO 10000
    10440 IF (IORCO.EQ.1R3) GO TO 10600
    C  FOR AIRCRAFT HOW MALFUNCTION CODE OF 799 IS ONLY KEPT WHEN THE ACTION
    C   CODE IS X.  FOR AGE, ALL 799S ARE KEPT.
    C        ON EQUIPMENT COMPUTATION
              NTYPE = 1
              IF ((MAL.EQ.3R803).O.(MAL.EQ.3R804)) GO TO 10380
              DO 10500 I=1,12
              IF (LATC.EQ.ATCS(I)) GO TO 10550
    10500 CONTINUE
              GO TO 10380
    10550 IF (I.EQ.3) GO TO 10000
              IF ((I.NE.1).A.(I.NE.2)) GO TO 10570
    C  GETDATA FOR AIRCRAFT DROPS HOW MALFUNCTION CODES OF 800 AND 805 FOR A
    C   TAKEN CODES OF P AND R AT THIS POINT.
    C  ACTION TAKEN CODES OF QS (INSTALLS) ARE DROPPED AND THE ELAPSED TIME
    C   PS (REMOVES) ARE DOUBLED IN COMBINE.
              SCOUNT=MA
    10570 IF (MA.GT.1) MA=1
              IF (LDISC-69) 10582,10581,10586
    C  WHEN DISC CODE OF  F  IN 3.
    C  WHEN DISC CODE OF  C  IN 1.
    10581 MTRXDIS(3)=MTRXDIS(3)+MA
              GO TO 10800
    10582 IF (LDISC-39) 10590,10583,10584
    10583 MTRXDIS(1)=MTRXDIS(1)+MA
              GO TO 10800
    10584 IF (LDISC-48) 10590,10585
    C  WHEN DISC CODE OF  D  IN 2.
    10585 MTRXDIS(2)=MTRXDIS(2)+MA
              GO TO 10800
    10586 IF (LDISC-158) 10590,10587
    C  WHEN DISC CODE OF  M  IN 4.
    10587 MTRXDIS(4)=MTRXDIS(4)+MA
              GO TO 10800
    C  OTHER WHEN DISC CODES IN 5.
    10590 MTRXDIS(5)=MTRXDIS(5)+MA
              GO TO 10800
    C        OFF EQUIPMENT COMPUTATION
    10600 NTYPE=2
              IF (IADJUST.EQ.6) NTYPE=6
              IF (LATC.GT.1R9.OR.LATC.LT.1R1.AND.LATC.NE.1RO) GO TO 10610
```

```
C     NRTS ITEM
      I = 18
      GO TO 10800
10610 DO 10620 I=4,17
      IF (LATC.EQ.ATCS(I)) GO TO 10650
10620 CONTINUE
      GO TO 10380
10650 IF (I.NE.5) GO TO 10800
      IF ((MAL.EQ.3R799).O.(MAL.EQ.3R804).O.(MAL.EQ.3R803)) GO TO 10800
      GO TO 10380
C  SERVICE  NTYPE=3 CHECKS
10700 NTYPE=3
      I=0
C  THE VARIABLE I POINTS TO THE CODE ASSIGNED IN THE ATCC VECTOR.
      IF (LT.EQ.1RA) I=6
      IF (LT.EQ.1RD) I=5
      IF (LT.EQ.1RP) I=3
      IF (LT.EQ.1RS) I=2
      IF (I.EQ.0) GO TO 10380
10800 IF (LCREW.EQ.1R0 ) GO TO 10380
      IF (MA.LT.5) GO TO 10810
      IF (ICNT.NE.59) GO TO 10805
      PRINT 100
      PRINT 200
      PRINT 300
      ICNT=0
10805 PRINT 45,JCN,LWC,LPPE,LTAIL,LT,LWUC,LATC,LDISC,MAL
     1,MA,LSTRT,LDAY,LSTOP,LCREW,MMH,LDTCLAS,IDRCD,LSUF
      ICNT=ICNT+1
10810 IF ((WUCLVL.EQ.5).OR.(I.EQ.18)) GO TO 10825
      IF (WUCLVL.EQ.4) GO TO 10815
      LWUC=(LWUC.A.3L:::).O.7R00
      GO TO 10825
10815 LWUC=(LWUC.A.4L::::).O.6R0
10825 CONTINUE
C  CHECK FOR DUPLICATE RECORDS
      IF (IHDAY.NE.LDAY) GO TO 10850
      IF ((IHSUF.NE.LSUF).O.(IHTAIL.NE.LTAIL)) GO TO 10850
      IF ((IHPRE.NE.LPRE).O.(IHLT.NE.LT)) GO TO 10850
      IF ((IHWUC.NE.LWUC).O.(IHATC.NE.LATC)) GO TO 10850
      IF ((IHDISC.NE.LDISC).O.(IHMAL.NE.MAL)) GO TO 10850
      IF ((IHMMH.NE.MMH).O.(IHWC.NE.LWC)) GO TO 10850
      IF ((IHJCN.NE.JCN).O. (IHSTOP.NE.LSTOP)) GO TO 10850
      IF ((IHCREW.NE.LCREW).O.(IHMA.NE.MA)) GO TO 10850
      IF ((IHSTRT.NE.LSTRT).O.(IHIDRCD.NE.IDRCD)) GO TO 10850
      IF (IHDTCLS.NE.LDTCLAS) GO TO 10850
      GO TO 10000
10850 WRITE (L1,10992) JCN,LTAIL,NTYPE,LWUC,ATCC(I),LWC,LSTDAY,LSTRT,
     1LCREW,MA,MMH,LDAY,LSTOP,SCOUNT
      IHTAIL=LTAIL
      IHPRE=LPRE
      IHLT=LT
      IHSUF=LSUF
      IHSTOP=LSTOP
      IHWUC=LWUC
      IHATC=LATC
      IHDISC=LDISC
```

```
      IHMAL=MAL
      IHMA=MA
      IHMM4=MMM
      IHWC=LWC
      IHDAY=LDAY
      IHSTRT=LSTRT
      IHCREW=LCREW
      IHOTCLS=LOTCLAS
      IHJCN=JCN
      IHIDRCD=IDRCD
      GO TO 10000
10900 M=M+1
      MM4=0
      IF (M.LE.NTAPE) GO TO 10000
      BACKSPACE 7
      WRITE (L1,10993)
      PRINT 10902,MDS
10902 FORMAT(1H1,30X,*UNSCHEDULED ON-EQUIPMENT MAINTENANCE FOR EQUIP. CL
     1ASS *,R2)
      PRINT 10989
      IWUCSUM=0
      DO 10910 J=1,5
      PERCENT(J)=0.
10910 IWUCSUM=IWUCSUM+MTRXDIS(J)
      IF (IWUCSUM.LE.0) STOP
      DO 10925 J=1,5
10925 PERCENT(J)=FLOAT(MTRXDIS(J))*100./FLOAT(IWUCSUM)
       PRINT 10990,(MTRXDIS(J),PERCENT(J),J=1,5)
10989 FORMAT(T5,*WHEN DISC*,T17,*C*,T34,*D*,T45,*F*,T64,*M*,T73,*OTHER*/
     1T13,*NO.*,T22,*%*,T28,*NO.*,T37,*%*,T43,*NO.*,T52,*%*,T58,*NO.*,T6
     26,*%*,T72,*NO.*,T81,*%*,//)
10990 FORMAT(T10,I6,T18,F5.1,T25,I6,T33,F5.1,T40,I6,T48,F5.1,T55,I6,T62,
     2F5.1,T69,I6,T76,F5.1)
10992 FORMAT(R7,R1,I1,A5,R1,R5,I3,R4,R1,I2,I4,I3,R4,I2)
10993 FORMAT(10H9999999999  ,35H00000000000000000000000000000000000)
      PRINT*,"IA=",IA,"IC=",IC,"IF=",IE,"IG=",IG
C-END FOR GETDATA ROUTINE
      END
```

APPENDIX C: AGEBINE DISCUSSION AND LISTING

The change in COMBINE (AFHRL-TR-74-97(III)) for SE was in the interpretation of the header card. The input for the ratio of ELAPSED TIME/MA is listed for on-equipment, off-equipment, and then for *service* type maintenance.

```
PROGRAM AGEBINE      74/74    OPT=1                        FTN 4.5+414       01/04/77  15.49.43       PAGE     1

                 PROGRAM AGEBINF(OUTPUT,INPUT,TAPE1,TAPE2,TAPES=INPUT,TAPE6=OUTPUT  11NOV6     1
                1.TAPE50)                                                           11NOV6     2
          C      READ RECORDS SORTED ON FIRST PASS AND COMBINE THEM                 AGEBIN     3
          C      COMPUTE CREW SIZE AND ELAPSED TIME                                 AGEBIN     4
          C      DEVELOP WORK CENTER CODE WHERE MORE THAN ONE INVOLVED              AGEBIN     5
          C      COMBINE-PARAMETER TELLS WHERE FILE CAN BE FOUND SHOULD             AGEBIN     6
          C      BE UNITS 1 OR 3                                                    AGEBIN     7
          C                                                                         AGEBIN     8
                 DIMENSION INFO(5,6,4),IAFSC(45),INDEX(4),NOM(3)                    AGEBIN     9
                 INTEGER TIME,SCOUNT,MSCOUNT,HJCN,WUC,ACT,DAY,WC,CREW,STRTHR,STRTMI AGEBIN    10
                1N,STPHR,STPMIN,HWUC,ELAP,HACT,WCS(4,6),CNTACT(6),STPDAY            AGEBIN    11
                 LOGICAL FLAG                                                       AGEBIN    12
                 DATA CNTACT/6*0/                                                   AGEBIN    13
                 ISUMS=0                                                            AGEBIN    14
                 ISUMMS=0                                                           AGEBIN    15
                 DO 12000 K=1,4                                                     AGEBIN    16
                 DO 12000 I=1,6                                                     AGEBIN    17
                 WCS(K,I)=0                                                         AGEBIN    18
                 DO 12000 J=1,5                                                     AGEBIN    19
          12000  INFO(J,I,K)=0                                                      AGEBIN    20
          C  THIS INPUT OF THE UPPER LIMIT FOR THE RATIO OF ELAPSED TIME AND MA PE  AGEBIN    21
          C  MAINTENANCE TYPE IS IN TENTHS OF HOURS (IE, MULTIPLY BY TEN THEN INPU  AGEBIN    22
          C  INTEGER).                                                              AGEBIN    23
          C  MAINTENANCE FILE TYPES: 1 ON-EQUIPMENT, 2 OFF-EQUIPMENT, 3 SERVICE     AGEBIN    24
                 READ 12001,LIMONEQ,LIMOFEQ,LIMSERV                                 AGEBIN    25
          12001  FORMAT(3I5)                                                        AGEBIN    26
                 DO 12003 I=1,45                                                    AGEBIN    27
                 READ(50,12002) IAFSC(I),NOM                                        11NOV6     3
          12002  FORMAT(R5,2A10,A6)                                                 AGEBIN    29
                 IF(EOF(50))12004,12003                                             11NOV6     4
          12004  NAFSC=I-1                                                          AGEBIN    31
                 GO TO 12005                                                        AGEBIN    32
          12003  PRINT 12006,I,IAFSC(I),NOM                                         AGEBIN    33
          12006  FORMAT(10X,I2,R10,5X,2A10,A6)                                      AGEBIN    34
                 NAFSC=45                                                           AGEBIN    35
          12005  IX=3R                                                              AGEBIN    36
                 LF = 2                                                             AGEBIN    37
                 L1=1                                                               AGEBIN    38
                 READ(LF,12993) HJCN,WUC,ACT,WC,DAY,STRTHR,STRTMIN,CREW,MA,LH,STPDA AGEBIN    39
                1Y,STPHR,STPMIN,SCOUNT                                              AGEBIN    40
                 IF (SCOUNT.GT.0) ISUMS=ISUMS+1                                     AGEBIN    41
                 GO TO 12500                                                        AGEBIN    42
          12050  READ(LF,12993)  JCN,WUC,ACT,WC,DAY,STRTHR,STRTMIN,CREW,MA,LH,STPDA AGEBIN    43
                1Y,STPHR,STPMIN,SCOUNT                                              AGEBIN    44
                 IF (EOF(LF)) 12900,12075                                           AGEBIN    45
          12075  CONTINUE                                                           AGEBIN    46
                 IF (SCOUNT.GT.0) ISUMS=ISUMS+1                                     AGEBIN    47
                 IF (JCN.EQ.HJCN) GO TO 12100                                       AGEBIN    48
                 HJCN = JCN                                                         AGEBIN    49
                 GO TO 12150                                                        AGEBIN    50
          12100  IF (WUC.EQ.HWUC) GO TO 12550                                       AGEBIN    51
          12150  KKK=SHIFT(HWUC,-30).A.1R:                                          AGEBIN    52
                 IF ((HACT.NE.5).O.(KKK.EQ.1R2)) GO TO 12153                        AGEBIN    53
                 ELAP=ELAP*2                                                        AGEBIN    54
                 MAN=MAN*2                                                          AGEBIN    55
          12153  IF (ELAP.GT.0) GO TO 12151                                         AGEBIN    56
                 PRINT 13000,ELAP,HACT,MAN,SUM2,HWUC,HJCN,WCS(IWC,HACT)             AGEBIN    57
```

```
          INFO(1,HACT,IMC)=0                                          AGEBIN   58
          WCS(IMC,HACT)=0                                             AGEBIN   59
          GO TO 12154                                                 AGEBIN   60
    12151 CONTINUE                                                    AGEBIN   61
C   ROUNDS UP FRACTIONAL MANNING                                      AGEBIN   62
          T = FLOAT(MAN)/FLOAT(FLAP)                                  AGEBIN   63
          J = T                                                       AGEBIN   64
          IF (T-FLOAT(J) .NE. 0) J = J+1                              AGEBIN   65
          CONTINUE                                                    AGEBIN   66
          INFO(1,HACT,IMC)=J                                          AGEBIN   67
          INFO(2,HACT,IMC)=MAN                                        AGEBIN   68
          INFO(3,HACT,IMC)=FLAP                                       AGEBIN   69
          INFO(4,HACT,IMC)=SUM2                                       AGEBIN   70
          INFO(5,HACT,IMC)=HSCOUNT                                    AGEBIN   71
    12154 IF (KKK.NE.1R2) GO TO 12210                                 AGEBIN   72
          ICHECK=0                                                    AGEBIN   73
          DO 12175 K=1,4                                              AGEBIN   74
          IF (INFO(1,4,K).LE.0) GO TO 12180                           AGEBIN   75
          IF (INFO(4,4,K).GT.0) GO TO 12175                           AGEBIN   76
          DO 12160 I=1,4                                              AGEBIN   77
          IF (INFO(1,3,I).LE.0) GO TO 12170                           AGEBIN   78
          IF (WCS(I,3).EQ.WCS(K,4)) GO TO 12170                       AGEBIN   79
    12160 CONTINUE                                                    AGEBIN   80
          LLL=3                                                       AGEBIN   81
          PRINT 12165,HWUC,KKK,WCS(K,4),(INFO(J,4,K),J=1,4),LLL       AGEBIN   82
    12165 FORMAT(* WARNING: TOO MANY WORKS CENTERS IN TEAM  WUC = *,R5,*  AGEBIN   83
         1TYPE = *,R1,*  AFSC = *,R5,*  CREW SIZE = *,I1/*  MMH*S = *,I5, AGEBIN   84
         2*  ELAPS TIME (1/10 HRS) = *,I5,*  MA*S = *,I4,*  ACT = *,I1)   AGEBIN   85
          INFO(1,4,K)=0                                               AGEBIN   86
          WCS(K,4)=0                                                  AGEBIN   87
          GO TO 12175                                                 AGEBIN   88
    12170 IF (INFO(1,4,K).GT.INFO(1,3,I))  INFO(1,3,I)=INFO(1,4,K)    AGEBIN   89
          INFO(2,3,I)=INFO(2,3,I)+INFO(2,4,K)                         AGEBIN   90
          INFO(3,3,I)=INFO(3,3,I)+INFO(3,4,K)                         AGEBIN   91
          INFO(1,4,K)=0                                               AGEBIN   92
          WCS(I,3)=WCS(K,4)                                           AGEBIN   93
          WCS(K,4)=0                                                  AGEBIN   94
          IF (ICHECK.EQ.1) GO TO 12175                                AGEBIN   95
          IX1=1                                                       AGEBIN   96
    12171 IF ((CNTACT(IX1).EQ.3).O.(CNTACT(IX1).EQ.0)) GO TO 12172    AGEBIN   97
          IX1=IX1+1                                                   AGEBIN   98
          IF (IX1.LE.6) GO TO 12171                                   AGEBIN   99
          STOP 7777                                                   AGEBIN  100
    12172 CNTACT(IX1)=3                                               AGEBIN  101
          ICHECK=1                                                    AGEBIN  102
    12175 CONTINUE                                                    AGEBIN  103
    12180 DO 12200 I=1,4                                              AGEBIN  104
          IF (INFO(1,3,I).LE.0) GO TO 12210                           AGEBIN  105
          INFO(4,3,I)=1                                               AGEBIN  106
          LLL=4                                                       AGEBIN  107
    12185 DO 12190 K=1,4                                              AGEBIN  108
          IF (WCS(I,3).EQ.WCS(K,LLL)) GO TO 12195                     AGEBIN  109
    12190 CONTINUE                                                    AGEBIN  110
          IF (LLL.EQ.6) GO TO 12200                                   AGEBIN  111
          LLL=6                                                       AGEBIN  112
          GO TO 12185                                                 AGEBIN  113
    12195 IF (INFO(1,LLL,K).LT.INFO(1,3,I))  INFO(1,LLL,K)=INFO(1,3,I) AGEBIN  114
```

```
              INFO(2,LLL,K)=INFO(2,LLL,K)+INFO(2,3,I)
              INFO(3,LLL,K)=INFO(3,LLL,K)+INFO(3,3,I)
              IF (INFO(4,LLL,K).LE.0) INFO(4,LLL,K)=1
              INFO(1,3,I)=WCS(I,3)=0
      12200 CONTINUE
      12210 IX1=1
      12220 I=CNTACT(IX1).A.78
              IF (I.LE.0) GO TO 12460
              IF (KKK.EQ.1R2) GO TO 12250
      12225 IF (WCS(2,I).LE.0) GO TO 12300
      12235 INDEX(1)=INDEX(2)=INDEX(3)=INDEX(4)=1R
              MAXFLAP=0
              ISUMCRW=0
              J=0
              DO 12237 K=1,4
      12236 IF (INFO(1,I,K).LE.0) GO TO 12237
              IF (MAXELAP.LT.INFO(3,I,K)) MAXELAP=INFO(3,I,K)
              INFO(4,I,K)=0
              J=J+1
              INDEX(J)=K
              ISUMCRW=ISUMCRW+INFO(1,I,K)
      12237 CONTINUE
      12238 FLAG=.F.
              K=1
      12239 IF (WCS(INDEX(K),I).LE.WCS(INDEX(K+1),I)) GO TO 12240
              J=INDEX(K)
              INDEX(K)=INDEX(K+1)
              INDEX(K+1)=J
              FLAG=.T.
      12240 K=K+1
              IF (K.GT.3) GO TO 12241
              IF (INDEX(K+1).NE.1R ) GO TO 12239
      12241 IF (FLAG) GO TO 12238
              INDEX(1)=WCS(INDEX(1),I)
              DO 12247  K=2,4
              IF (INDEX(K).EQ.1R ) GO TO 12248
              DO 12245 J=1,NAFSC
              IF (WCS(INDEX(K),I).EQ.IAFSC(J)) GO TO 12246
      12245 CONTINUE
              INDEX(K)=1R
              GO TO 12247
      12246 INDEX(K)=J
      12247 CONTINUE
      12248 J=0
              K=1
              WRITE (L1,12249) INDEX(1),INDEX(2),INDEX(3),INDEX(4),HWUC
            1,KKK,I,ISUMCRW,J,MAXELAP,K ,J
      12249 FORMAT(R5,3R1,R5,R1,I1,I2,2I5,I4,I2)
              GO TO 12450
      12250 IF ((I.NE.3).A.(I.NE.4).A.(I.NE.6)) GO TO 12225
              J=0
              DO 12275 LLL=1,4
      12275 IF (INFO(1,I,LLL).GT.0) J=J+1
              IF (J-1) 12450,12300,12235
      12300 DO 12440 K=1,4
              IF (INFO(1,I,K).LE.0) GO TO 12440
              IF (INFO(4,I,K).LT.0) INFO(4,I,K)=0
```

```
      IF (INFO(4,I,K).EQ.0) GO TO 12425
      IF (KKK.NE.1R1) GO TO 12401
      IF (INFO(3,I,K)/INFO(4,I,K).LE.LIMONEQ) GO TO 12425
      PRINT 13300,LIMONEQ, WCS(K,I),HWUC,KKK,I,(INFO(J,I,K),J=1,5)
      GO TO 12440
12401 IF (KKK.NE.1R2) GO TO 12402
      IF (INFO(3,I,K)/INFO(4,I,K).LE.LIMOFEQ) GO TO 12425
      PRINT 13300,LIMOFEQ,WCS(K,I),HWUC,KKK,I,(INFO(J,I,K),J=1,5)
      GO TO 12440
12402 IF (KKK.NE.1R3) GO TO 12404
      IF (INFO(3,I,K)/INFO(4,I,K).LE.LIMSFRV) GO TO 12425
      PRINT 13300,LIMSFRV,WCS(K,I),HWUC,KKK,I,(INFO(J,I,K),J=1,5)
      GO TO 12440
12404 PRINT 13400,WCS(K),HWUC,KKK,I,(INFO(J,I,K),J=1,5)
      GO TO 12440
12425 IF ((IX.EQ.1R    ).A.(INFO(4,I,K).LE.0)) GO TO 12440
      IF (INFO(5,I,K).LE.99) GO TO 11113
      WRITE(6,11112)  INFO(5,I,K)
11112 FORMAT(1X,"   INFO(5,I,K)  EXCEEDS 99.    SCOUNT =",I6)
      INFO(5,I,K) = 99
11113 CONTINUE
      IF (INFO(5,I,K).GT.0) ISUMHS=ISUMHS+1
      WRITE (L1,12991) IX,WCS(K,I),HWUC         ,KKK,I,(INFO(J,I,K),J=1,
     15)
12440 CONTINUE
12450 CONTINUE
      IX1=IX1+1
      IF(IX1.LE.6) GO TO 12220
12460 DO 12475 KKK=1,6
12475  CNTACT(KKK)=0
      DO 12495 K=1,4
      DO 12485 I=1,6
      WCS(K,I)=0
      DO 12485 J=1,5
12485 INFO(J,I,K)=0
12500 HWUC = WUC
      IWC=0
      GO TO 12750
12550 IF((ACT.EQ.HACT).A.(WC.EQ.WCS(IWC,HACT)))GO TO 12800
      IACT=0
      IF (ACT.NE.HACT) IACT=1
      KKK=SHIFT(HWUC,-30).A.1R?
      IF ((HACT.NE.5).O.(KKK.EQ.1R2)) GO TO 12575
      ELAP=ELAP*2
      MAN=MAN*2
12575 IF (ELAP.GT.0) GO TO 12625
      PRINT 12600,WCS(IWC,HACT),     MAN,HACT,HWUC,SUM2
      WCS(IWC,HACT)=0
      IWC=IWC-1
12600 FORMAT(" WARNING: ELAPS TIME NOT > 0 FOR WC = ",R5,"  MMH = ",I4,
     1"  ACT = ",I1,"  WUC = ",R6,"  AND MA = ",I2)
      GO TO 12700
C   ROUNDS UP FRACTIONAL MANNING
12625 T= FLOAT(MAN)/FLOAT(ELAP)
      J=T
      IF (T-FLOAT(J).NE.0) J=J+1
      INFO(1,HACT,IWC)=J
```

PROGRAM AGEBINE   74/74   OPT=1   FTN 4.5+414   01/04/77 15.49.43   PAGE   5

```
      INFO(2,HACT,INC)=MAN
      INFO(3,HACT,INC)=ELAP
      INFO(4,HACT,INC)=SUM2
      INFO(5,HACT,INC)=HSCOUNT
12700 IF (IACT.EQ.1) INC=0
12750 INC=INC+1
      DO 12760 KKK=1,6
      IF (ACT.EQ.CNTACT(KKK)) GO TO 12765
      IF (CNTACT(KKK).NE.0) GO TO 12760
      CNTACT(KKK)=ACT
      GO TO 12765
12760 CONTINUE
C  STOP TIME SMALLER THAN START TIME DAYS ADJUSTED IN GETDATA.
12765 ELAP=(LH+CREW-1)/CREW
      MAN=LH
      TIME=1440*STPDAY+60*STPHR+STPMIN
      HSCOUNT=SCOUNT
      HACT=ACT
      SUM2=MA
      IF (INC.LE.4) GO TO 12775
      KKK=SHIFT(HWUC,-30).A.1R!
      PRINT 12165,HWUC,KKK,WC,J,MAN,ELAP,SUM2,HACT
      FLAP=0
      GO TO 12050
12775 WCS(INC,HACT)=WC
      GO TO 12050
C  JCN,TYPE,WUC,ACT, AND WC*S ARE THE SAME AS PREVIOUS RECORD
12800 HSCOUNT = HSCOUNT + SCOUNT
      MIN = 1440*DAY+60*STRTHR+STRTMIN
      MAN = MAN + LH
      IF (SUM2.LT.MA) SUM2=MA
      IF (MIN.GE.TIME) GO TO 12050
      MIN=1440*STPDAY+60*STPHR+STPMIN
      IF (MIN.LE.TIME) GO TO 12050
      ELAP = ELAP + (MIN-TIME)/6
      GO TO 12050
12050 FLAP = ELAP+ (LH+CREW-1)/CREW
      GO TO 12050
12900 WRITE (L1,12992)
      PRINT 101,ISUMS,ISUMHS
  101 FORMAT (* COMBINE ISUMS=*,I10,*ISUMHS=*,I10)
      ENDFILE L1
C
12991 FORMAT(R3,2R5,R1,I1,I2,2I5,I4,I2)
12992 FORMAT(11H:::99999999,22H0000000000000000000000)
12993 FORMAT(R10,R6,R1,R5,I3,2I2,I1,I2,I4,I3,3I2)
13000 FORMAT(//5X*ELAP=*,I2,3X*HACT=*,I2,3X*MAN=*,I2,3X*MA=*,F4.1,3X*WU
     1C=*,R5,3X*JCN=*,R10,3X*WCS=*,R8)
13300 FORMAT(* FLAP/MA>*,I5,* SO THE FOLLOWING RECORD WAS DROPPED*,9XR8,
     13XR5,3XR1,3XI1,3XI2,3XI5,3XI5,3XI4,3XI2)
13400 FORMAT(* WARNING- THE FOLLOWING RECORD DID NOT HAVE AN ACCEPTABLE
     1FILE TYPE (IE. 1- ON EQUIP, 2- OFF EQUIP, OR 3- SERV):*
     2   /1X,R8,R5,R1,I1,I2,2I5,I4,2I2)
C
C      END FOR COMBINE
       END "ABSENT"
```

APPENDIX D: REPAGE DISCUSSION AND LISTING

REPORT (AFHRL-TR-97(III)) was altered to allow the SE SERVICE file to split out 4 instead of 3 action types (based on the LT in GETAGE).

PROGRAM REPAGE   74/74   OPT=1   FTN 4.5+414   01/04/77 15.59.41   PAGE   1

```
      PROGRAM REPAGE(OUTPUT,INPUT,TAPE2,TAPE8,TAPE9,TAPE10,TAPE11,
     1TAPE12)
C TAPE2 IS DISK FILE FROM SORTED COLLECT PROGRAM OUTPUT
C TAPE8-TAPE11 ARE FILES FOR EACH TYPE
C TAPE12 IS OUTPUT FILE FOR DATA BY WUC,ONE RECORD FOR EACH
C WUC ENTERED IN TAPE12 - SPEC FILE
      DIMENSION INFO1(1000),            INFO3(1000),
     1INFO4(1000),INFO5(1000),INFO6(1000),INFO7(1000),
     2INFO9(1000),MMRCD(7),RCD1(5,7),RCD2(5,7)
      COMMON/LIMT/MTYPE
      INTEGER SCOUNT3,Y13,CHECK3,Y1,Y14,CHECK,CHECK4,SCOUNT,SCOUNT5,
     1SCOUNT4,WUC4,MWUC4,WUC5,MWUC5,TYPE,MTYPE,WCID,MWCID,MWUC3
     2,ELAP,CREW,ACT,RCD1,RCD2,ZERO(77),A1(7),A2(7),A3(7),A4(7),A5(7)
      LOGICAL WUC3SW,WUC4SW,NORCDS
      EQUIVALENCE (ZERO(1),MMRCD(1)),(ZERO(8),RCD1(1,1)),
     1(ZERO(43),RCD2(1,1))
      ISUMS=0
      ISUMI=0
C
      CHECK=NRTS=Y1=CHECK4=NRTS4=Y14=MWUC4=SCOUNT5=SCOUNT4=SCOUNT3=NRTS3
     1=Y13=CHECK3=0
      NRTS1=NRTS14=NRTS13=0
      ICOUNT5=ICOUNT4=ICOUNT3=0
      WUC4SW=WUC3SW=NORCDS=.TRUE.
      DO 17001 I=1,77
17001 ZERO(I)=0
      L2=12
      LF=2
      READ (LF,17995) WUC4,WUC5,TYPE,WCID,ACT,CREW,MMM,  MA,ELAP,SCOUNT
      IF (SCOUNT.GT.0) ISUMS=ISUMS+1
      MWUC3=WUC4.A.777777000
      MWUC4=WUC4
      MWUC5=WUC5
      MTYPE=TYPE.A.70
      MWCID=WCID.A.0R!!!!!!!!
      L1=7+TYPE
      GO TO 17010
17000 READ (LF,17995) WUC4,WUC5,TYPE,WCID,ACT,CREW,MMM,  MA,ELAP,SCOUNT
      IF (IOCHEC(LF)) 17000,8
    8 CONTINUE
      IF (EOF(LF)) 17900,17010
17010 CONTINUE
      IF (SCOUNT.GT.0) ISUMS=ISUMS+1
      IF ((WUC4.EQ.4R2300).A.(TYPE.EQ.2)) CREW = MA=ELAP=0
      IF (WUC4.EQ.MWUC4) GO TO 17020
      WUC4SW=.FALSE.
      IF ((WUC4.A.777777000).NE.MWUC3) WUC3SW = .F.
      GO TO 17030
17020 IF (WUC5.EQ.MWUC5) GO TO 17060
17030 IF(ICOUNT5.GE.9999)ICOUNT5=9939
      WRITE (L2,17994) MWUC4,MWUC5,CHECK,NRTS,NRTS1,Y1,
     1SCOUNT5,ICOUNT5
      Y14=Y14+Y1
      CHECK4=CHECK4+CHECK
      NRTS14=NRTS14+NRTS1
      NRTS4=NRTS4+NRTS
      SCOUNT4 = SCOUNT4 + SCOUNT5
```

```
      ICOUNT4=ICOUNT4+ICOUNT5
      ICOUNT5=0
      SCOUNT5=NRTS=CHECK=Y1=NRTS1=0
      GO TO 17070
17060 IF (TYPE.NE.HTYPE) GO TO 17070
      IF (HCID.EQ.HHCID) GO TO 17230
17070 IF (NORCDS) GO TO 17120
      K2=0
      K1=SHIFT(HTYPE,48).OR.HHCID
      IF (HTYPE.NE.2) GO TO 17071
      NI = 7
      NJ = 4
      GO TO 17072
17071 IF (HTYPE.EQ.3) GO TO 17073
      NI=4
      NJ = 5
      GO TO 17072
17073 NI=4
      NJ=5
17072 DO 17080 I = 1,NI
      K2=HHRCD(I)
      DO 17080 J = 1,NJ
      IF ((RCD1(J,I).EQ.0).A.(K2.EQ.0).A.(RCD2(J,I).EQ.0)) GO TO 17080
      IF (HWUC4.GE.999) GO TO 17075
      HWUC4=HWUC4+1
      INFO1(HWUC4)=K1
      INFO3(HWUC4)=K2
      K2=0
      INFO4(HWUC4)=I
      INFO5(HWUC4)=J
      INFO6(HWUC4)=RCD1(J,I)
      INFO7(HWUC4)=RCD2(J,I)
      INFO9(HWUC4)=HWUC4
      GO TO 17080
17075 PRINT 17999,K1    ,K2,RCD1(J,I),RCD2(J,I),HWUC4,HWUC5
17080 CONTINUE
      CALL CLEANUP
      IF ((HTYPE.LE.0).OR.(HTYPE.GT.5)) HTYPE=5
      GO TO (17090,17100,17110,17090,17120),HTYPE
17090 WRITE (L1,17991) HWUC4,HWUC5,HHCID,
     1(HHRCD(I),(RCD1(J,I),RCD2(J,I),J=1,5),I=1,4)
      GO TO 17120
17100 WRITE (L1,17992) HWUC4,HWUC5,HHCID,(HHRCD(I)
     1,(RCD1(J,I),RCD2(J,I),J=1,4),I=1,7)
      GO TO 17120
17110 WRITE (L1,17991) HWUC4,HWUC5,HHCID,
     1(HHRCD(K1),(RCD1(J,K1),RCD2(J,K1),J=1,5),K1=1,4)
17120 IF (HUC4SW) GO TO 17210
      CALL SORT(INFO1,INFO9,HWUC4)
      HWUC4=HWUC4+1
      INFO1(HWUC4)=9R999999999
      INFO9(HWUC4)=HWUC4
      DO 17130 I=1,77
17130 ZERO(I)=0
      HWUC5=1R
      HHCID=INFO1(INFO9(1)).A.9R111111111
      IF (HWUC4.LE.1000) GO TO 17131
```

```
              PRINT 1,NWUC4
        1     FORMAT(1X,*NWUC4.GT.1000 -- *,I10)
              NWUC4=1000
        17131 DO 17200 I=1,NWUC4
              K1=INFO3(I).A.77777777B
              IF (K1.LE.1000) GO TO 17132
              PRINT 2,K1
        2     FORMAT(* K1.GT.1000 -- *,I10)
              GO TO 17200
        17132 IF ((INFO1(K1).A.9R::::::::::).NE.HWCID) GO TO 17140
        17135 K2=INFO4(K1).A.77B
              IF (K2.LE.7) GO TO 17136
              PRINT 3,K2
        3     FORMAT(* K2.GT.7 -- *,I10)
              GO TO 17200
        17136 K3 = INFO5(K1).A.7B
              IF (K3.LE.5) GO TO 17137
              PRINT 4,K3
        4     FORMAT(* K3.GT.5 -- *,I10)
              GO TO 17200
        17137 MHRCD(K2)=MHRCD(K2)+INFO3(K1)
              RCD1(K3,K2)=RCD1(K3,K2)+INFO6(K1)
              RCD2(K3,K2)=RCD2(K3,K2)+INFO7(K1)
              GO TO 17200
        17140 HTYPE=SHIFT(HWCID,-48).A.7B
              L1 = 7+HTYPE
              CALL CLEANUP
              IF ((HTYPE.LE.0).OR.(HTYPE.GT.5)) HTYPE=5
              GO TO (17150,17160,17170,17150,17180),HTYPE
        17150 WRITE (L1,17991) HWUC4,HWUC5,HWCID,
             1(MHRCD(K1),(RCD1(J,K1),RCD2(J,K1),J=1,5),K1=1,4)
              GO TO 17180
        17160 WRITE (L1,17992) HWUC4,HWUC5,HWCID,(MHRCD(K1)
             1,(RCD1(J,K1),RCD2(J,K1),J=1,4),K1=1,7)
              GO TO 17180
        17170 WRITE (L1,17991) HWUC4,HWUC5,HWCID,
             1(MHRCD(K1),(RCD1(J,K1),RCD2(J,K1),J=1,5),K1=1,4)
        17180 K1 = INFO9(I).A.4R::::
              HWCID=INFO1(K1).A.9R::::::::::
              DO 17190 J=1,77
        17190 ZERO(J)=0
              IF (I.LT.NWUC4) GO TO 17135
        17200 CONTINUE
              NWUC4=0
              IF(ICOUNT4.GE.9999)ICOUNT4=9999
              WRITE (L2,17994) HWUC4,HWUC5,CHECK4,NRTS4,NRTS14,Y14
             1,SCOUNT4,ICOUNT4
              ICOUNT3=ICOUNT3+ICOUNT4
              ICOUNT4=0
              SCOUNT3=SCOUNT3+SCOUNT4
              Y13=Y13+Y14
              NRTS3=NRTS3+NRTS4
              NRTS13=NRTS13+NRTS14
              CHECK3=CHECK3+CHECK4
              SCOUNT4=NRTS4=CHECK4=Y14=NRTS14=0
        17210 IF (NUC3SW) GO TO 17215
              IF(ICOUNT3.GE.9999)ICOUNT3=9999
```

```
      MWUC3=MWUC3.O.1R
      WRITE (L2,17994) MWUC3,MWUC5,CHECK3,NRTS3,NRTS13,V13,SCOUNT3
     1,ICOUNT3
      ICOUNT3=0
      SCOUNT3=NRTS3=CHECK3=V13=NRTS13=0
17215 IF (MUC4.EQ.4R9999) GO TO 17980
      MWUC3=WUC4.A.777777000
      MWUC4=WUC4
      MWUC5=WUC5
      MTYPE=TYPE.A.70
      MWCID=WCID.A.0R11111111
      L1 = 7 + TYPE
      WUC3SW=WUC4SW=NORCOS=.TRUE.
      DO 17220 I=1,77
17220 ZERO(I)=0
17230 CONTINUE
C     TYPE = MTYPE, WCID = MWCID
      NORCOS=.F.
      IF (TYPE.NE.2) GO TO 17275
      IF ((ACT.LE.0).O.(ACT.GT.6)) GO TO 17550
C     SHOP ACTIONS
      GO TO (17240,17245,17265,17250,17255,17260),ACT
17240 LOCODE=1
      V1=V1+MA
      GO TO 17400
17245 CHECK=CHECK+MA
      LOCODE=2
      GO TO 17400
17250 LOCODE=5
      V1=V1+MA
      GO TO 17400
17255 LOCODE=4
      GO TO 17400
17260 IF (MWUC5.EQ.1R0) GO TO 17261
      LOCODE=7
      NRTS1=NRTS1+MA
      GO TO 17400
17261 NRTS=NRTS+MA
      LOCODE=6
      GO TO 17400
17265 LOCODE=3
      GO TO 17400
C     ON-EQUIP,ON-ENGINE, AND SCHED. ACTIONS
17275 IF ((ACT.LE.0).O.(ACT.GT.4)) GO TO 17550
      GO TO (17300,17310,17320,17330),ACT
17300 LOCODE=1
      GO TO 17400
17310 LOCODE=3
      GO TO 17400
17320 LOCODE=4
      GO TO 17400
17330 LOCODE=2
      IF (MA.GT.0) ISUMI=ISUMI+1
      ICOUNT5=ICOUNT5+MA
      SCOUNT5=SCOUNT5+SCOUNT
17400 IF (LOCODE.GT.7) GO TO 17000
      IF (CREW.LE.0) GO TO 17500
```

```
      RCD1(CREW,LOCODE)=RCD1(CREW,LOCODE)+MA
      RCD2(CREW,LOCODE)=RCD2(CREW,LOCODE)+FLAP
17900 MMRCD(LOCODE)=MMRCD(LOCODE)+MMM
      GO TO 17000
17550 PRINT 17950,WUC4,WUC5,TYPE,WCID,ACT
17950 FORMAT(* RECORD DROPPED BECAUSE ACT WAS INVALID.  WUC= *,R4,R1,
     1* TYPE = *,I1,* AFSC =*,R8,* ACT = *,I1)
      GO TO 17090
17980 DO 17981 I = 9,12
17981 ENDFILE I
      REWIND 11
      PRINT 101,ISUMS,ISUMI
  101 FORMAT (* REPORT ISUMS=*,I12,*ISUMI=*,I10)
      WRITE (8,17985)
17985 FORMAT(13H9999999999999/60H999999999999999999999999999999999999999999
     13999999999999999999999999999999/60H999999999999999999999999999999999999
     29999999999999999999999999999999/60H9999999999999999999999999999999999
     3999999999999999999999999999999999999999/60H99999999999999999999999999
     49999999999999999999999999999999999999999999999999999)
17986 READ (11,17989) A1,A2,A3,A4,A5
      IF (EOF(11)) 17988,17987
17987 WRITE (8,17989) A1,A2,A3,A4,A5
      GO TO 17986
17988 ENDFILE 8
C
17989 FORMAT (A10,A3/6A10,A6/6A10,A6/6A10,A6/6A10,A6)
17991 FORMAT(R4,R1,R8/I8,5(2I6)/I8,5(2I6)/I8,5(2I6)/I8,5(2I6))
17992 FORMAT(R4,R1,R8,I8,4(2I6)/I8,4(2I6),I8,4(2I6)/I8,4(2I6),I8,4(2I6)/
     1I8,4(2I6),I8,4(2I6))
17993 FORMAT(R4,R1,R8/I8,5(2I6)/I8,5(2I6)/I8,5(2I6))
17994 FORMAT(R4,R1,4I5,2I4)
17995 FORMAT(R4,R1,I1,R8,2I1,I8,2I6,I3)
17996 FORMAT(1X,*WARNING! SCHEDULED MAINTENANCE HAS AN ENTRY*,
     1* IN LCOM *,R1,* CREW SIZE MATRIX FOR WUC = *,R4,R1,
     2*, AFSC = *,R8,*, AND MA = *,I3)
17999 FORMAT(*WARNING- THERE WERE MORE THAN 999 RECORDS WITHIN 4 LEVEL W
     1UC.  THE FOLLOWING RECORD WAS DROPPED*/5X,*TYPE AND AFSC = *,R9,
     2*, MMM = *,I8,*, MA = *,I6,*, NO. OF OCCURANCES = *,I6,*, ELAP = *
     3,I6,*, FOR WUC = *,R4,R1)
C
      END
```

APPENDIX E: THREAGE DISCUSSION AND LISTING

THRELVL (AFHRL-TR-74-97(III)) was modified to allow the SERVICE file to have 4 action type breakouts instead of 3.

```
PROGRAM THREAGE      74/74    OPT=1                              FTN 4.5+414          01/04/77  15.56.27        PAGE     1

            PROGRAM THREAGE(OUTPUT,TAPE8,TAPE9,TAPE10,TAPE19)                                 THRAGE     2
            INTEGER FORMAT1(8),FORMAT2(8),FORMAT3(8),TYPE(2),TYPF(2),TYPG(2)                  THRAGE     3
            DATA (TYPE=10HON-EQUIP. ,10HAND ENGINE)                                           THRAGE     4
            DATA (TYPF=10HOFF-EQUIPM,10HAINTENANCE)                                           THRAGE     5
            DATA (TYPG=10HSCHEDULEDM,10HAINTENANCE)                                           THRAGE     6
            DATA (FORMAT1=10H(R5,R8/I8.,10H5(2I6)/I8.,10H5(2I6)/I8.,10H5(2I6)/               THRAGE     7
           1I8.,7L5(2I6)),0B,0B,0B)                                                           THRAGE     8
            DATA (FORMAT2=10H(R5,R8,I8.,10H4(2I6)/I8.,10H4(2I6),I8.,10H4(2I6)/               THRAGE     9
           1I8.,10H4(2I6),I8.,10H4(2I6)/I8.,10H4(2I6),I8.,7L4(2I6)))                          THRAGE    10
            DATA (FORMAT3=10H(R5,R8/I8.,10H5(2I6)/I8.,10H5(2I6)/I8.,7L5(2I6)),                THRAGE    11
           10B,0B,0B,0B)                                                                      THRAGE    12
            PRINT 9,FORMAT1                                                                   THRAGE    13
            CALL THREEM(44,FORMAT1)                                                           THRAGE    14
            ENDFILE 19                                                                        THRAGE    15
      C   ON-EQUIPMENT AND ENGINE FILES SUMMARIZED AND MERGED                                 THRAGE    16
            PRINT 8,TYPE                                                                      THRAGE    17
            PRINT 9,FORMAT2                                                                   THRAGE    18
            CALL THREEM(63,FORMAT2)                                                           THRAGE    19
            ENDFILE 19                                                                        THRAGE    20
      C   OFF-EQUIPMENT FILE SUMMARIZED AND MERGED                                            THRAGE    21
            PRINT 8,TYPF                                                                      THRAGE    22
            PRINT 9,FORMAT1                                                                   THRAGE    23
            CALL THREEM(44,FORMAT1)                                                           THRAGE    24
            ENDFILE 19                                                                        THRAGE    25
      C   SCHEDULED-MAINTENANCE FILE SUMMARIZED AND MERGED                                    THRAGE    26
            PRINT 8,TYPG                                                                      THRAGE    27
            STOP 53771                                                                        THRAGE    28
      8     FORMAT(1X,2A10,*   SUMMARIZED AND MERGED*)                                        THRAGE    29
      9     FORMAT(1X,*FORMAT USED: *,8A10)                                                   THRAGE    30
            END                                                                               THRAGE    31
```

APPENDIX F: PRINTAGE DISCUSSIONS AND LISTING

PRINTOUT modifications include QPA set to 1, the header card for each maintenance type file has an equipment class code and up to as many as 14 FIIN codes inputs available when needed for printout purposes only. The SERVICE file only prints out line by line summaries of data by WUC, AFSC, crew size, overtime, MAs per maintenance type, MMH and MMH/100. Further summaries and tables which are given for ON-EQUIPMENT are suppressed. (Also, no longer in overlap format because of the computer system changes.) PRINTAGE is repeated for all of the equipment class codes which were processed through the SE data bank program series in one run.

```
      PROGRAM PRNTAGE(INPUT,OUTPUT,TAPE5=INPUT,TAPE8,TAPE9,TAPE10)       PRAGE    2
      DIMENSION MMH(7),MA(5,7),ELAP(5,7),NACTS(4),NCREW(4),IUNUSED(263), PRAGE    3
     1IFIIN(14)                                                          PRAGE    4
      REAL MMH                                                           PRAGE    5
      INTEGER SCOUNT                                                     PRAGE    6
      INTEGER MASK(3),WUC,WCID,FORMAT(6),BLK(3),OPA,AFSC(3)              PRAGE    7
      COMMON/INFO1/WUC,OPA,AFSC,WCID/INFO2/ICHECK,NRTS,NRTS1,Y1,SCOUNT   PRAGE    8
     1,ICOUNT                                                            PRAGE    9
      COMMON/INFO3/MMH,MA,ELAP,LIM1,LIM2,ICOMPAR,FLYHRS,SORTIES,LVL,     PRAGE   10
     1IEOF,IFILE                                                         PRAGE   11
      COMMON/INFO4/IUNUSED                                               PRAGE   12
      DATA NACTS/4,7,4,4/,NCREW/5,4,5,5/,MASK/2R::,1R:,0/,BLK/2R  ,1R ,0 PRAGE   13
     1/,OPA/1/                                                           PRAGE   14
      PRINT 10003,                                                       PRAGE   15
10003 FORMAT(1H1,T52,*AFSC MASTER LIST FOR TEAMS*//T47,*CHAR.*,T57,*AFSC PRAGE   16
     1*,T67,*NOMENCLATURE*)                                              PRAGE   17
      DO 10006 I=1,45                                                    PRAGE   18
      READ (19,10004) WCID,AFSC                                          PRAGE   19
10004 FORMAT(R5,2A10,A6,49X)                                             PRAGE   20
      IF (EOF(10)) 10007,10006                                           PRAGE   21
10006 PRINT 10005,I,WCID,AFSC                                            PRAGE   22
10005 FORMAT(T47,R1,T57,R5,T67,2A10,A6)                                  PRAGE   23
10007 REWIND 10                                                          PRAGE   24
10001 READ (5,10000) SORTIES,FLYHRS,IFILE,LVLWUC,IEQPCL1,IEQPCL2,        PRAGE   25
     1(IFIIN(I),I=1,14),FORMAT                                           PRAGE   26
10000 FORMAT(F10.4,F10.4,2I1,2R1,14(1X,R3)/6A10)                         PRAGE   27
      IF (EOF(5)) 10022,10023                                            PRAGE   28
10022 STOP 52323                                                         PRAGE   29
10023 IF  ((IFILE.LE.0).O.(IFILE.GT.4)) GO TO 10001                      PRAGE   30
      LVLWUC=LVLWUC-2                                                    PRAGE   31
      IF ((LVLWUC.LT.1).O.(LVLWUC.GT.3)) LVLWUC=3                        PRAGE   32
      IEOF=0                                                             PRAGE   33
      DO 10026 I=1,263                                                   PRAGE   34
10026 IUNUSED(I)=0                                                       PRAGE   35
C  IF FIRST CHAR. OF EQUIPMENT CLASS CODE IS A 0, THEN IT IS A DUMMY     PRAGE   36
C  ASSIGNED CODE BASED ON GROUPINGS OF FIIN DESIGNATORS.                 PRAGE   37
      IF (IEQPCL1.LE.320) GO TO 10160                                    PRAGE   38
      PRINT 10159,SORTIES, FLYHRS,IFILE,(IFIIN(I),I=1,14)                PRAGE   39
10159 FORMAT(*1FOR THIS RUN THERE ARE*,F10.4,* SORTIES AND*,F11.4,* FLYI PRAGE   40
     1NG HOURS FOR MAINTENANCE TYPE*,I2,* FOR AGE EQUIPMENT WITH*/10X,   PRAGE   41
     2*FIIN DESIGNATORS LISTED AS: *,14(R3,2X)////)                      PRAGE   42
      GO TO 10161                                                        PRAGE   43
10160 PRINT 10002,SORTIES,FLYHRS,IFILE,IEQPCL1,IEQPCL2                   PRAGE   44
10002 FORMAT(*1FOR THIS RUN THERE ARE*,F10.4,* SORTIES AND*,F11.4,* FLYI PRAGE   45
     1NG HOURS FOR MAINTENANCE TYPE*,I2,* FOR AGE EQUIPMENT *,2R1////)   PRAGE   46
10161 LVL=5                                                              PRAGE   47
      LIM1=NACTS(IFILE)                                                  PRAGE   48
      LIM2=NCREW(IFILE)                                                  PRAGE   49
10025 READ (8,FORMAT)WUC,WCID,(MMH(I),(MA(J,I),ELAP(J,I),J=1,LIM2),I=1,  PRAGE   50
     1LIM1)                                                              PRAGE   51
      IF (ICCHEC(8)) 10025,10030                                         PRAGE   52
10030 IF (EOF(8)) 10050,10100                                            PRAGE   53
10050 IEOF=1                                                             PRAGE   54
      IF (LVL.EQ.5) GO TO 10001                                          PRAGE   55
      IF (IFILE.EQ.2) GO TO 10075                                        PRAGE   56
      CALL ONEQP                                                         PRAGE   57
      GO TO 10001                                                        PRAGE   58
```

```
PROGRAM PRNTAGE    74/74    OPT=1                    FTN 4.5+414     01/04/77  16.12.03     PAGE    2

        10075 CALL OFFEQP                                                        PRAGE
              GO TO 10001                                                        PRAGE
        10100 IF (WUC.EQ.5R99999) GO TO 10050                                    PRAGE
              IF ((MASK(LVLWUC).A.WUC).NE.BLK(LVLWUC)) GO TO 10025               PRAGE
              IF (IFILF.EQ.2) CALL FNDOPA                                        PRAGE
              CALL FNDAFSC                                                       PRAGE
              IF ((1R!.A.WUC).EQ.1R ) GO TO 10110                                PRAGE
              ICOMPAR=5                                                          PRAGE
              GO TO 10150                                                        PRAGE
        10110 IF ((77000B.A.WUC).EQ.5500B) GO TO 10125                           PRAGE
              ICOMPAR=4                                                          PRAGE
              GO TO 10150                                                        PRAGE
        10125 ICOMPAR=3                                                          PRAGE
        10150 IF (IFILF.EQ.2) GO TO 10175                                        PRAGE
              CALL ONEQP                                                         PRAGE
              GO TO 10025                                                        PRAGE
        10175 CALL OFFEQP                                                        PRAGE
              GO TO 10025                                                        PRAGE
              END                                                                PRAGE
```

ABBREVIATIONS AND DEFINITIONS

SYMBOL	DEFINITION
ABD64A	Magnetic computer tapes with recorded maintenance activity.
AGE	Aerospace Ground Equipment
BASIC AGE	Part II of MDCAGE program
BASIC RUN	Part II of MDC program
EQ/CL	Equipment Class Code
LCOM	Logistics Composite Model
MDBF	Mean Dispatches Between Failures
MDC	Maintenance Data Collection
MDCAGE	Maintenance Data Collection Program for SE
MDS	Mission Design Series
MMH	Maintenance Man-Hours
MMM	Maintenance Manpower Models
NIIN	National Item Identification Number
PE	Phase Inspection
PHASE I	An MMM pre-processor model
PRINTAGE	Part III of MDCAGE program
PRINTOUT	Part III of MDC program
SE	Support Equipment
TRNAGE	Part I of MDCAGE program
TRN9T07	Part I of MDC program
UE	Unit Equipment

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